POWER TRANSISTOR DATABOOK

NATIONAL SEMICONDUCTOR

POWER TRANSISTOR DATABOOK

92-Plus 1

TO-202 2

TO-220 3

TO-126 4

TO-3 5

Processes 6

Introduction

Here is the new Power Transistor catalog from National Semiconductor Corporation. It contains information on all of National's Power Transistors, as of this date.

Included in this catalog is a part number to process conversion listing and a reference guide showing all device types available for any process/package combination.

Because National is rapidly expanding its Power Transistor capability, if you don't find the device you want, contact your nearest sales representative for additional information.

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Manufactured under one or more of the following U.S. patents: 3083262, 3189758, 3231797, 3303356, 3317671, 3323071, 3381071, 3408542, 3421025, 3426423, 3440498, 3518750, 3519897, 3557431, 3560765, 3566218, 3571630, 3575609, 3579059, 3593069, 3597640, 3607469, 3617859, 3631312, 3633052, 3638131, 3648071, 3651565, 3693248.

Devices are identified by a part number consisting of both alpha and numeric digits. Part numbers may be either JEDEC or PRO Electron registered numbers, or in-house numbers. Examples of each follow.

1. 2N4918 JEDEC Registered Numbering System
   BD675 PRO Electron Type Designating Code

2. **92PU01**

   Device Number

   Package Prefix

PACKAGE	PREFIX
D40, D41	TO-202
D42, D43	TO-202
D44, D45	TO-220
MJE	TO-126, TO-220
NCBJ	TO-126
NCBS	TO-39
NCBT	TO-92
NCBW	TO-220
NSD	TO-202
NSP	TO-220
TIP	TO-220
92P	92-Plus

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	MAXIMUM RATINGS (Notes 1 and 2)	PACKAGE: 92 + (ECB) $P_D = 1\ W$ @ $T_A = 25°C$ NPN	92 + (ECB) PNP	92 + (EBC) $P_D = 1\ W$ @ $T_A = 25°C$ NPN	92 + (EBC) PNP	TO-202 (EBC) $P_D = 1.75\ W$ @ $T_A = 25°C$, $P_D = 10\ W$ @ $T_C = 25°C$ NPN	TO-202 (EBC) PNP	TO-202 (BCE) $P_D = 1.75\ W$ @ $T_A = 25°C$, $P_D = 10\ W$ @ $T_C = 25°C$ NPN	TO-202 (BCE) PNP	TO-126 $P_D = 1.5\ W$ @ $T_A = 25°C$, $P_D = 40\ W$ @ $T_C = 25°C$ NPN	TO-126 PNP	TO-220 $P_D = 2\ W$ @ $T_A = 25°C$, $P_D = 90\ W$ @ $T_C = 25°C$ NPN	TO-220 PNP	TO-3 $P_D = 150\ W$ @ $T_C = 25°C$ NPN	TO-3 PNP
DARLINGTON POWER	$BV_{CEO} = 50V$, $I_C = 1.5A$, (P05)			92PU45 92PU45A		NSDU45 NSDU45A NSD151 NSD152 NSD153 NSD154 D40C1-8									
DARLINGTON POWER	$BV_{CEO} = 100V$, $I_C = 6A$, (P2J/3J)									BD675 BD675A BD677 BD677A BD679 BD679A MJE800-3 NSP2102 2N6037-9	BD676 BD676A BD678 BD678A BD680 BD680A MJE700-3 NSP2091 2N6034-6	NSP695 NSP695A NSP697 NSP697A NSP699 NSP699A NSP701 NSP2100 NSP2101 NSP2103 TIP110-3 2N6386	NSP696 NSP696A NSP698 NSP698A NSP700 NSP700A NSP702 NSP2090 NSP2092 NSP2093 TIP115-7		
DARLINGTON POWER	$BV_{CEO} = 100V$, $I_C = 10A$, (P4K/5K)											TIP121 TIP122	TIP125-7	2N6055-9 2N6300 2N6301 MJ1000 MJ1001	2N6050-4 2N6298 2N6299 MJ900 MJ901
HIGH VOLTAGE	$BV_{CEO} = 500V$, $I_C = 100\ mA$, (P48)	92PE487 92PE488 92PE489		92PU10 92PU391 92PU392 92PU393		NSDU10 NSD131-5 NSD3439 NSD3440									
HIGH VOLTAGE	$BV_{CEO} = 350V$, $I_C = 500\ mA$, (P36)									MJE340 MJE341 MJE344 MJE3439 MJE3440 2N5655 2N5656 2N5657					

	MAXIMUM RATINGS (Notes 1 and 2)	PACKAGE													
		92 + (ECB)		92 + (EBC)		TO-202 (EBC)		TO-202 (BCE)		TO-126		TO-220		TO-3	
		P_D = 1 W @ T_A = 25°C		P_D = 1 W @ T_A = 25°C		P_D = 1.75 W @ T_A = 25°C P_D = 10 W @ T_C = 25°C		P_D = 1.75 W @ T_A = 25°C P_D = 10 W @ T_C = 25°C		P_D = 1.5 W @ T_A = 25°C P_D = 40 W @ T_C = 25°C		P_D = 2 W @ T_A = 25°C P_D = 90 W @ T_C = 25°C		P_D = 150 W @ T_C = 25°C	
		NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP
GENERAL PURPOSE	BV_{CEO} = 45V, I_C = 1.5A, (P37)	BD373A BD373A-10 BD373A-16 BD373A-25		BD371A BD371A-10 BD371A-16 BD371A-25 92PU01 92PU01A		D40D1-5 NSDU01-3 NSDU01A		D42C1-6 NSE180		BD135 MJE180 MJE720					
	BV_{CEO} = 45V, I_C = 1.5A, (P77)				BD372A BD372A-10 BD372A-16 BD372A-25 92PU51 92PU51A		D41D1 D41D2 D41D4 D41D5 D41E1 NSDU51 NSDU51A NSDU52 NSD202 NSD203		D43C1-6 NSE170		BD136 MJE170 MJE710				
	BV_{CEO} = 80V, I_C = 1.5A, (P38)	BD373B BD373B-10 BD373B-16 BD373B-25 BD373C BD373C-6 BD373C-10 BD373C-16 92PE37A 92PE37B 92PE37C		BD371B BD371B-10 BD371B-16 BD371B-25 BD371C BD371C-6 BD371C-10 BD371C-16		D40D7 D40D8 D40D10 D40D11 D40D13 D40D14 D40E1 D40E5 D40E7 NSDU05 NSD6178 NSD6179		D42C7-12 NSE181		BD137 MJE181 MJE721					
	BV_{CEO} = 80V, I_C = 1.5A, (P78)		BD372A BD372A-10 BD372A-16 BD372A-25 BD372B BD372B-10 BD372B-16 BD372B-25 BD372C BD372C-6 BD372C-10		BD370A BD370A-10 BD370A-16 BD370A-25 BD370B BD370B-10 BD370B-16 BD370B-25 BD370C BD370C-6 BD370C-10		D41D7 D41D8 D41D10 D41D11 D41D13 D41D14 D41E5 D41E7 NSDU55 NSD6180 NSD6181		D43C7-12 NSE171		BD138 MJE171 MJE711				

Power Transistor Reference Guide

GENERAL PURPOSE

MAXIMUM RATINGS (Notes 1 and 2)	PACKAGE: 92 + (ECB) P_D = 1 W @ T_A = 25°C		92 + (EBC) P_D = 1 W @ T_A = 25°C		TO-202 (EBC) P_D = 1.75 W @ T_A = 25°C P_D = 10 W @ T_C = 25°C		TO-202 (BCE) P_D = 1.75 W @ T_A = 25°C P_D = 10 W @ T_C = 25°C		TO-126 P_D = 1.5 W @ T_A = 25°C P_D = 40 W @ T_C = 25°C		TO-220 P_D = 2 W @ T_A = 25°C P_D = 90 W @ T_C = 25°C		TO-3 P_D = 150 W @ T_C = 25°C	
	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP
BV_{CEO} = 80V, I_C = 1.5A, (P78)		BD372C-16 92PE77A 92PE77B 92PE77C		BD370C-16										
BV_{CEO} = 110V, I_C = 1.5A, (P39)	BD373D BD373D-6 BD373D-10		BD371D BD371D-6 BD371D-10 92PU05 92PU06 92PU07		NSDU06 NSDU07 NSD104-6				BD139 MJE182 MJE722					
BV_{CEO} = 110V, I_C = 1.5A, (P79)		BD372D BD372D-6 BD372D-16		BD370D BD370D-6 BD370D-16 92PU55 92PU56 92PU57	NSDU56 NSDU57 NSDU204-6				BD140 MJE172 MJE712					
BV_{CEO} = 100V, I_C = 3A, (P2C/3C)									BD233 BD235 BD237 BD433 BD435 BD437 BD439 BD441 BD520 BD521 2N4921-3	BD234 BD236 BD238 BD434 BD436 BD438 BD440 BD442 MJE370 MJE520 MJE521 2N4918-20	D44C1 D44C2 D44C4 D44C5 D44C7 D44C8 D44C10 NSP520 NSP521 NSP575 NSP577 NSP579 NSP581 NSP2520 NSP4921-3 TIP29 TIP29A,B,C TIP31 TIP31A,B,C TIP61 TIP61A,B,C	D45C1 D45C2 D45C4 D45C5 D45C7 D45C8 D45C10 NSP370 NSP576 NSP578 NSP580 NSP582 NSP2370 NSP4918-20 TIP30 TIP30A,B,C TIP32 TIP32A,B,C TIP62 TIP62A,B,C		
BV_{CEO} = 100V, I_C = 6A, (P2E/3E)									2N5190-2	MJE371 2N5193-5	D44C3 D44C6 D44C11 D44C12	D45C3 D45C6 D45C11 D45C12		

GENERAL PURPOSE

MAXIMUM RATINGS (Notes 1 and 2)	PACKAGE												
	92 + (ECB)		92 + (EBC)		TO-202 (EBC)		TO-202 (BCE)		TO-126		TO-220		
	P_D = 1 W @ T_A = 25°C		P_D = 1 W @ T_A = 25°C		P_D = 1.75 W @ T_A = 25°C P_D = 10 W @ T_C = 25°C		P_D = 1.75 W @ T_A = 25°C P_D = 10 W @ T_C = 25°C		P_D = 1.5 W @ T_A = 25°C P_D = 40 W @ T_C = 25°C		P_D = 2 W @ T_A = 25°C P_D = 90 W @ T_C = 25°C		P
	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NP
BV_{CEO} = 100V, I_C = 6A, (P2E/3E)											NSP41 NSP41A NSP41B NSP41C NSP585 NSP587 NSP589 NSP595 NSP597 NSP599 NSP5190-2 2N5293-8 2N6121-3 2N6129-31 2N6288-93	NSP42 NSP42A NSP42B NSP42C NSP371 NSP586 NSP588 NSP590 NSP596 NSP598 NSP600 NSP5193-5 2N6124-6 2N6132-4 NSP2490 NSP2491	
BV_{CEO} = 100V, I_C = 8A, (P4A/5A)											NSP205 NSP2020 NSP2021 NSP2480-3 NSP3055 NSP5977-9 TIP41 TIP41A,B,C	NSP105 NSP2010 NSP2011 NSP2955 NSP5974-6 TIP42 TIP42A,B,C 2N6106-11	2N305 2N587 2N587 2N587 2N587 MJ280 MJ284 MJ305
BV_{CEO} = 100V, I_C = 12A, (P4B/5B)													2N371 2N563 2N575 2N625 2N625 2N637
BV_{CEO} = 100V, I_C = 15A, (P4C/5C)													2N562 2N575 2N5881 2N588 2N625 2N625

Note 1: BV_{CEO} and I_C values are maximum ratings. For specific conditions and limits, refer to individual process data sheets.

Note 2: Process numbers are in parentheses.

National Semiconductor Power Transistor Listing

PART NUMBER	PROCESS	PART NUMBER	PROCESS	PART NUMBER	PROCESS	PART NUMBER	PROCESS
BD135	37	BD371B-16	38	BD377-16	38	BD680A	3J
BD136	77	BD371B-25	38	BD377-25	38	BD681	2J
BD137	38	BD371C	38	BD377-6	38	BD682	3J
BD138	78	BD371C-10	38	BD378	78	BD733	2C
BD139	39	BD371C-16	38	BD378-10	78	BD734	3E
BD140	79	BD371C-6	38	BD378-16	78	BD735	2C
BD201	2G	BD371D	39	BD378-25	78	BD736	3E
BD202	3G	BD371D-10	39	BD378-6	78	BD737	2C
BD233	2C	BD371D-6	39	BD379	39	BD738	3E
BD234	3C	BD372A	78	BD379-10	39	D40C1	05
BD235	2C	BD372A-10	78	BD379-16	39	D40C2	05
BD236	3C	BD372A-16	78	BD379-25	39	D40C3	05
BD237	2C	BD372A-25	78	BD379-6	39	D40C4	05
BD238	3C	BD372B	78	BD380D-6	79	D40C5	05
BD239	2C	BD372B-10	78	BD380	79	D40C7	05
BD239A	2C	BD372B-16	78	BD380-10	79	D40C8	05
BD239B	2C	BD372B-25	78	BD380-16	79	D40D1	38
BD239C	2C	BD372C	78	BD380-25	79	D40D10	38
BD240	3C	BD372C-10	78	BD433	2E	D40D11	38
BD240A	3C	BD372C-16	78	BD434	3E	D40D13	38
BD240B	3C	BD372C-6	78	BD435	2E	D40D14	38
BD240C	3C	BD372D	79	BD436	3E	D40D2	38
BD241	2C	BD372D-10	79	BD437	2E	D40D3	38
BD241A	2C	BD372D-6	79	BD438	3E	D40D4	38
BD241B	2C	BD373A	37	BD439	2E	D40D5	38
BD241C	2C	BD373A-10	37	BD440	3E	D40D7	38
BD242	3E	BD373A-16	37	BD441	2E	D40D8	38
BD242A	3E	BD373A-25	37	BD442	3E	D40E1	38
BD242B	3E	BD373B	38	BD533	2E	D40E5	38
BD242C	3E	BD373B-10	38	BD534	3E	D40E7	38
BD370A	78	BD373B-16	38	BD535	2E	D40N1	48
BD370A-10	78	BD373B-25	38	BD536	3E	D40N2	48
BD370A-16	78	BD3730	38	BD537	2E	D40N3	48
BD370A-25	78	BD3730-10	38	BD538	3E	D40N4	48
BD370B	78	BD373C-16	38	BD633	2C	D40N5	48
BD370B-10	78	BD373C-6	38	BD634	3C	D40P1	15
BD370B-16	78	BD373C	39	BD635	2C	D40P3	15
BD370B-25	78	BD373C-10	39	BD636	3C	D40P5	15
BD370C	78	BD373D-6	39	BD637	2C	D41D1	78
BD370C-10	78	BD375	38	BD638	3C	D41D10	78
BD370C-16	78	BD375-10	38	BD675	2J	D41D11	78
BD370C-6	78	BD375-16	38	BD675A	2J	D41D13	78
BD370D	79	BD375-25	38	BD676	3J	D41D14	78
BD370D-10	79	BD375-6	38	BD676A	3J	D41D2	78
BD370D-6	79	BD376	78	BD677	2J	D41D4	78
BD371A	37	BD376-10	78	BD677A	2J	D41D5	78
BD371A-10	37	BD376-16	78	BD678	3J	D41D7	78
BD371A-16	37	BD376-25	78	BD678A	3J	D41D8	78
BD371A-25	37	BD376-6	78	BD679	2J	D41E1	78
BD371B	38	BD377	38	BD679A	2J	D41E5	78
BD371B-10	38	BD377-10	38	BD680	3J	D41E7	78

National Semiconductor Power Transistor Listing (Continued)

PART NUMBER	PROCESS	PART NUMBER	PROCESS	PART NUMBER	PROCESS	PART NUMBER	PROCESS
D42C1	37	D45C3	3E	NSDU45	05	NSP520	2C
D42C10	38	D45C4	3C	NSDU45A	05	NSP521	2C
D42C11	38	D45C5	3C	NSDU51	77	NSP575	2C
D42C12	38	D45C6	3E	NSDU51A	77	NSP576	3C
D42C2	37	D45C7	3C	NSDU52	77	NSP577	2C
D42C3	37	D45C8	3C	NSDU55	78	NSP578	3C
D42C4	37	D45C9	3E	NSDU56	79	NSP579	2C
D42C5	37	D45H1	5A	NSDU57	79	NSP580	3C
D42C6	37	D45H10	5A	NSD102	37	NSP581	2C
D42C7	38	D45H11	5A	NSD103	37	NSP582	3C
D42C8	38	D45H2	5A	NSD104	39	NSP585	2E
D42C9	38	D45H4	5A	NSD105	39	NSP586	3E
D42R1	36	D45H5	5A	NSD106	39	NSP587	2E
D42R2	36	D45H7	5A	NSD123	08	NSP588	3E
D43C1	77	D45H8	5A	NSD127	15	NSP589	2E
D43C10	38	MJE170	77	NSD128	15	NSP590	3E
D43C11	78	MJE171	78	NSD129	15	NSP595	2E
D43C12	78	MJE172	79	NSD131	48	NSP596	3E
D43C2	77	MJE180	37	NSD132	48	NSP597	2E
D43C3	77	MJE181	38	NSD134	48	NSP5974	5A
D43C4	77	MJE182	39	NSD135	48	NSP5975	5A
D43C5	77	MJE340	36	NSD151	05	NSP5976	5A
D43C6	77	MJE341	36	NSD152	05	NSP5977	4A
D43C7	78	MJE3439	36	NSD153	05	NSP5978	4A
D43C8	78	MJE344	36	NSD154	05	NSP5979	4A
D43C9	78	MJE3440	36	NSD202	77	NSP598	3E
D44C1	2C	MJE370	3C	NSD203	77	NSP5980	5A
D44C10	2C	MJE371	3E	NSD204	79	NSP5981	5A
D44C11	2E	MJE520	2C	NSD205	79	NSP5982	5A
D44C12	2E	MJE521	2C	NSD206	79	NSP5983	4A
D44C2	2C	MJE700	3J	NSD3439	36	NSP5984	4A
D44C3	2E	MJE701	3J	NSD3440	36	NSP5985	4A
D44C4	2C	MJE702	3J	NSD457	48	NSP599	2E
D44C5	2C	MJE703	3J	NSD458	48	NSP600	3E
D44C6	2E	MJE710	77	NSD459	48	NSP601	4A
D44C7	2C	MJE711	78	NSD6178	38	NSP602	5A
D44C8	2C	MJE712	79	NSD6179	38	NSP695	2J
D44C9	2E	MJE720	37	NSD6180	78	NSP695A	2J
D44H1	4A	MJE721	38	NSD6181	78	NSP696	3J
D44H10	4A	MJE722	39	NSE170	77	NSP696A	3J
D44H11	4A	MJE800	2J	NSE171	78	NSP697	2J
D44H2	4A	MJE801	2J	NSE180	37	NSP697A	2J
D44H4	4A	MJE802	2J	NSE181	38	NSP698	3J
D44H5	4A	MJE803	2J	NSE457	48	NSP698A	3J
D44H7	4A	NSDU01	37	NSE458	48	NSP699	2J
D44H8	4A	NSDU01A	37	NSE459	48	NSP699A	2J
D45C1	3C	NSDU02	37	NSP5191	2E	NSP700	3J
D45C10	3C	NSDU05	38	NSP5192	2E	NSP700A	3J
D45C11	3E	NSDU06	39	NSP5193	3E	NSP701	2J
D45C12	3E	NSDU07	39	NSP5194	3E	NSP105	5A
D45C2	3C	NSDU10	48	NSP5195	3E	NSP2010	5A

National Semiconductor Power Transistor Listing (Continued)

PART NUMBER	PROCESS	PART NUMBER	PROCESS	PART NUMBER	PROCESS	PART NUMBER	PROCESS
NSP2011	5A	TIP131	4K	2N6050	5K	2N5871	5A
NSP2020	4A	TIP132	4K	2N6051	5K	2N5872	5A
NSP2021	4A	TIP135	5K	2N6052	5K	2N5875	5A
NSP205	4A	TIP136	5K	2N6053	5K	2N5876	5A
NSP2090	3J	TIP137	5K	2N6054	5K	2N6594	5A
NSP2091	3J	TIP29	2C	2N6298	5K	2N3713	4B
NSP2092	3J	TIP29A	2C	2N6299	5K	2N3714	4B
NSP2093	3J	TIP29B	2C	2N5655	36	2N3715	4B
NSP2100	2J	TIP29C	2C	2N5656	36	2N3716	4B
NSP2101	2J	TIP30	3C	2N5657	36	2N5632	4B
NSP2102	2J	TIP30A	3C	2N4921	2C	2N5633	4B
NSP2103	2J	TIP30B	3C	2N4922	2C	2N5634	4B
NSP2370	3C	TIP30C	3C	2N4923	2C	2N5758	4B
NSP2480	4A	TIP31	2C	2N4918	3C	2N5759	4B
NSP2481	4A	TIP31A	2C	2N4919	3C	2N5760	4B
NSP2482	4A	TIP31B	2C	2N4920	3C	2N6253	4B
NSP2483	4A	TIP31C	2C	2N5293	2E	2N6254	4B
NSP2490	3E	TIP32	3C	2N5294	2E	2N6371	4B
NSP2491	3E	TIP32A	3C	2N5295	2E	2N3789	5B
NSP2520	2C	TIP32B	3C	2N5296	2E	2N3790	5B
NSP2955	5A	TIP32C	3C	2N5297	2E	2N3791	5B
NSP3054	2E	TIP41	4A	2N5298	2E	2N3792	5B
NSP3055	4A	TIP41A	4A	2N6121	2E	2N6226	5B
NSP370	3C	TIP41B	4A	2N6122	2E	2N6227	5B
NSP371	3C	TIP41C	4A	2N6123	2E	2N6228	5B
NSP3740	3C	TIP42	5A	2N6129	2E	2N6229	5B
NSP3741	3C	TIP42A	5A	2N6130	2E	2N6230	5B
NSP41	2E	TIP42B	5A	2N6131	2E	2N6231	5B
NSP41A	2E	TIP42C	5A	2N6288	2E	2N5629	4C
NSP41B	2E	TIP61	2C	2N6289	2E	2N5630	4C
NSP41C	2E	TIP61A	2C	2N6290	2E	2N5631	4C
NSP42	3E	TIP61B	2C	2N6291	2E	2N5758	4C
NSP42A	3E	TIP61C	2C	2N6292	2E	2N5759	4C
NSP42B	3E	TIP62	3C	2N6293	2E	2N5760	4C
NSP42C	3E	TIP62A	3C	2N6124	3E	2N5881	4C
NSP4918	3C	TIP62B	3C	2N6125	3E	2N5882	4C
NSP4919	3C	TIP62C	3C	2N6126	3E	2N6257	4C
NSP4920	3C	2N6386	2J	2N6132	3E	2N6258	4C
NSP4921	2C	2N6037	2J	2N6133	3E	2N5879	5C
NSP4922	2C	2N6038	2J	2N6134	3E	2N5880	5C
NSP4923	2C	2N6039	2J	2N6106	5A	2N6029	5C
NSP5190	2E	2N6034	3J	2N6107	5A	2N6030	5C
NSP702	3J	2N6035	3J	2N6108	5A	2N6031	5C
TIP110	2J	2N6036	3J	2N6109	5A		
TIP111	2J	2N6055	4K	2N6110	5A		
TIP112	2J	2N6056	4K	2N6111	5A		
TIP115	3J	2N6057	4K	2N3055	4A		
TIP116	3J	2N6058	4K	2N5873	4A		
TIP117	3J	2N6059	4K	2N5874	4A		
TIP120	2J	2N6300	4K	2N5877	4A		
TIP130	4K	2N6301	4K	2N5878	4A		

Section 1

92-Plus

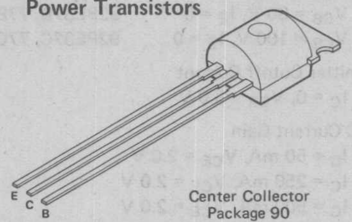
1

92-PLUS

NPN
92PE37A thru 92PE37C
PNP
92PE77A thru 92PE77C

Complementary plastic power transistors employing double diffused planar structures and constructed with National's revolutionary "Epoxy B Concept" for exceptional reliability.

Complementary NPN/PNP Audio Power Transistors



Center Collector
Package 90

Features

- High V_{CE} ratings:
  92PE37A, 77A – 45 V min. V_{CEO}
  92PE37B, 77B – 60 V min. V_{CEO}
  92PE37C, 77C – 80 V min. V_{CEO}
- Exceptional power dissipation capability:
  $P_{TOT\,P}$ = 1.2 Watts @ T_A = 25°C

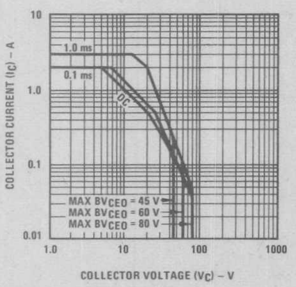
Maximum Ratings

Parameter	Symbol	92PE37A 92PE77A	92PE37B 92PE77B	92PE37C 92PE77C	Units
Collector-Emitter Voltage	V_{CEO}	45	60	80	V_{DC}
Collector-Base Voltage	V_{CB}	45	60	80	V_{DC}
Emitter-Base Voltage	V_{EB}	5.0	5.0	5.0	V_{DC}
Collector Current (cont.)	I_C	1.0	1.0	1.0	A_{DC}
Collector Current	I_{CM}	2.0	2.0	2.0	A_{DC}
Power Dissipation (T_A = 25°C)	P_{TOT}	0.75	0.75	0.75	W
(T_C = 25°C)		2.5	2.5	2.5	W
Practical Power Dissipation*	$P_{TOT\,P}$	1.2	1.2	1.2	W
Temperature	T_j, T_{stg}	-55 to +150	-55 to +150	-55 to +150	°C
Thermal Resistance	θ_{JA}	167	167	167	°C/W
	θ_{JC}	50	50	50	°C/W

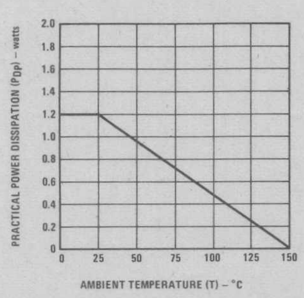
* Practical Power Dissipation (i.e., that power which can be dissipated with the device installed in a typical manner on a printed circuit board with total copper run area equal to 1 sq. in. minimum).

Typical Performance Characteristics

Safe Operating Area Curve

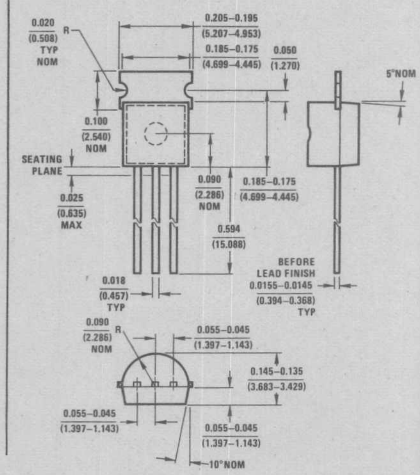


Thermal Derating Curve



Physical Dimensions

92-PLUS



Electrical Characteristics

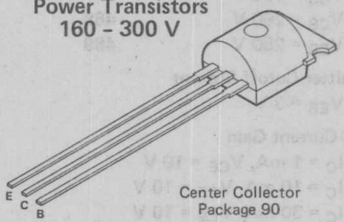
Parameter	Symbol	Min.	Max.	Units
Collector-Emitter Sustaining Voltage	BV_{CEO}			
I_C = 10 mA, I_B = 0 92PE37A, 77A		45		V
92PE37B, 77B		60		V
92PE37C, 77C		80		V
Collector Cutoff Current	I_{CBO}			
V_{CB} = 60 V, I_E = 0 92PE37A, 77A			0.1	μA
V_{CB} = 80 V, I_E = 0 92PE37B, 77B			0.1	μA
V_{CB} = 100 V, I_E = 0 92PE37C, 77C			0.1	μA
Emitter Cutoff Current	I_{EBO}			
I_C = 0, V_{EB} = 5.0 V			100	nA
DC Current Gain	h_{FE}			
I_C = 50 mA, V_{CE} = 2.0 V		40		
I_C = 250 mA, V_{CE} = 2.0 V		40		
I_C = 500 mA, V_{CE} = 2.0 V		25		
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$			
I_C = 500 mA, I_B = 50 mA			0.5	V
I_C = 1000 mA, I_B = 100 mA			1.0	V
Base-Emitter ON Voltage	$V_{BE(on)}$			
I_C = 1000 mA, V_{CE} = 2.0 V			1.5	V
Current Gain Bandwidth Product	f_T			
I_C = 200 mA, V_{CE} = 5 V, f = 100 MHz		50		MHz
Output Capacitance	C_{ob}			
V_{CB} = 10 V, I_E = 0, f = 1 MHz			30	pF

92-PLUS

92PE487 thru 92PE489

Triple diffused planar structures built with National's revolutionary "Epoxy B Concept." Designed to provide exceptional reliability and performance.

High Voltage Silicon NPN Power Transistors 160 - 300 V



Center Collector
Package 90

Features

- TV video output
- TV chroma output
- Line operated class "A" audio

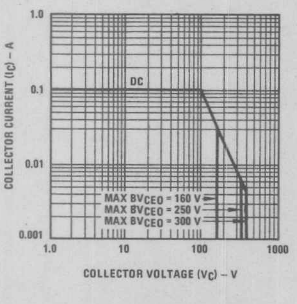
Maximum Ratings

Parameter	Symbol	92PE487	92PE488	92PE489	Units
Collector-Base Voltage	V_{CB}	160	250	300	V_{DC}
Collector-Emitter Voltage	V_{CEO}	160	250	300	V_{DC}
Emitter-Base Voltage	V_{EB}	7	7	7	V_{DC}
Collector Current (cont.)	I_C	0.1	0.1	0.1	A_{DC}
Collector Current	I_{CM}	0.3	0.3	0.3	A_{DC}
Base Current	I_B	50	50	50	mA_{DC}
Power Dissipation ($T_A = 25°C$)	P_{TOT}	0.75	0.75	0.75	W
($T_C = 25°C$)		2.5	2.5	2.5	W
Practical Power Dissipation*	$P_{TOT\ P}$	1.2	1.2	1.2	W
Temperature	T_j, T_{stg}	-55 to +150	-55 to +150	-55 to +150	°C
Thermal Resistance	θ_{JA}	71.4	71.4	71.4	°C/W
	θ_{JC}	12.5	12.5	12.5	°C/W

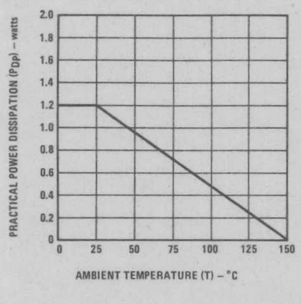
* Practical Power Dissipation (i.e., that power which can be dissipated with the device installed in a typical manner on a printed circuit board with total copper run area equal to 1 sq. in. minimum).

Typical Performance Characteristics

Safe Operating Area Curve

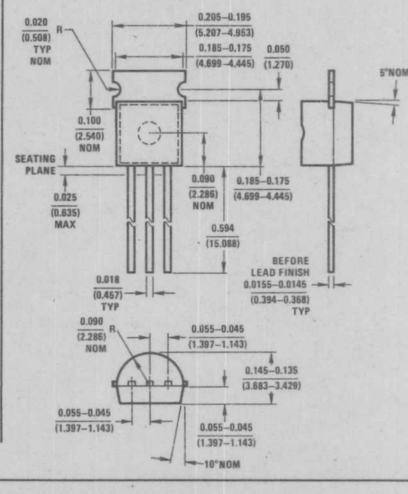


Thermal Derating Curve



Physical Dimensions

92-PLUS



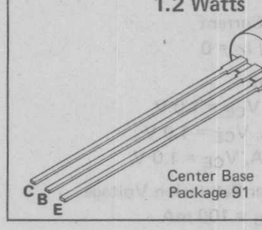
Electrical Characteristics

Parameter		Symbol	Min.	Max.	Units
Collector-Emitter Sustaining Voltage		BV_{CEO}			
I_C = 5 mA, I_B = 0	487		160		V_{DC}
	488		250		V_{DC}
	489		300		V_{DC}
Collector Cutoff Current		I_{CBO}			
V_{CB} = 100 V	487			50	nA
V_{CB} = 200 V	488				
V_{CB} = 250 V	489				
Emitter Cutoff Current		I_{EBO}			
V_{EB} = 3 V				50	nA
DC Current Gain					
I_C = 1 mA, V_{CE} = 10 V		h_{FE1}	15		
I_C = 10 mA, V_{CE} = 10 V		h_{FE2}	15		
I_C = 30 mA, V_{CE} = 10 V		h_{FE3}	30		
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$			
I_C = 30 mA, I_B = 6 mA				1.0	V_{DC}
High Frequency Knee Voltage		V_{CEK}			
I_C = 50 mA			typ. 15		V_{DC}
Collector-Base Junction Capacitance		C_{cb}			
V_{CB} = 20 V				3.0	pF
Transition Frequency		f_T			
I_C = 10 mA				typ. 50	MHz

92-PLUS

NPN
92PU01, 92PU01A
PNP
92PU51, 92PU51A

Complementary NPN/PNP Silicon Audio Power Transistors 1.2 Watts



Center Base
Package 91

Complementary plastic power transistors employing double diffused planar structures and constructed with National's revolutionary "Epoxy B Concept" for exceptional performance and reliability.

Applications

- Class "B" audio outputs/drivers
- General purpose switching and lamp drive in industrial and automotive circuits

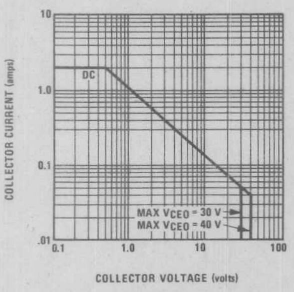
Maximum Ratings

Parameter	Symbol	92PU01 92PU51	92PU01A 92PU51A	Units
Collector-Emitter Voltage	V_{CEO}	30	40	V
Collector-Base Voltage	V_{CB}	40	50	V
Emitter-Base Voltage	V_{EB}	5.0	5.0	V
Collector Current (cont.)	I_C	2.0	2.0	A
Power Dissipation ($T_A = 25°C$)	P_{DP}*	1.2	1.2	W
Temperature	T_j, T_{stg}	-55 to +150	-55 to +150	°C
Thermal Resistance	θ_{JA}	167	167	°C/W
	θ_{JC}	50	50	°C/W

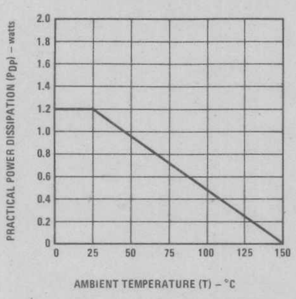
*P_{DP} = Practical Power Dissipation, i.e., that power which can be dissipated with the device installed in a typical manner on a printed circuit board with total copper run area equal to 1.0 in.^{2} minimum.

Typical Performance Characteristics

Safe Operating Area Curve

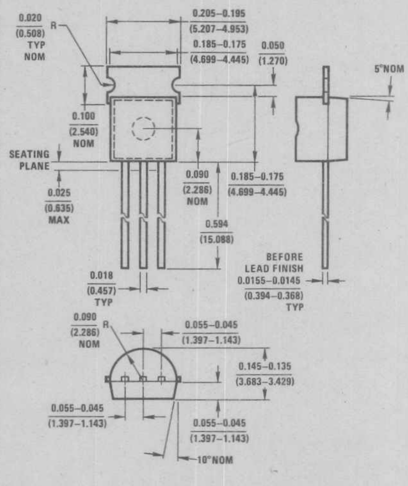


Thermal Derating Curve



Physical Dimensions

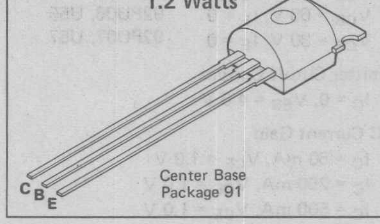
92-PLUS



$I_C = 10$ mA, $I_B = 0$				
92PU01, U51		30		V
92PU01A, U51A		40		V
Collector Cutoff Current	I_{CBO}			
$V_{CB} = 40$ V, $I_E = 0$			0.1	μA
$V_{CB} = 50$ V, $I_E = 0$			0.1	μA
Emitter Cutoff Current				
$V_{EB} = 5.0$ V, $I_C = 0$			0.1	μA
DC Current Gain	h_{FE}			
$I_C = 10$ mA, $V_{CE} = 1.0$ V		55		A
$I_C = 100$ mA, $V_{CE} = 1.0$ V		60		?
$I_C = 1000$ mA, $V_{CE} = 1.0$ V		50		
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$			
$I_C = 1.0$ A, $I_B = 100$ mA			0.5	V
Base-Emitter ON Voltage	$V_{BE(on)}$			
$I_C = 1.0$ A, $V_{CE} = 1.0$ V			1.2	V
Current-Gain Bandwidth Product	f_t			
$I_C = 50$ mA, $V_{CE} = 10$ V, f = 20 MHz		50		MHz
Output Capacitance	C_{ob}			
$V_{CB} = 10$ V, $I_E = 0$, f = 1 MHz			30	pF

92PU55 thru 92PU57

Complementary NPN/PNP Audio Power Transistors 1.2 Watts



Complementary plastic power transistors employing double diffused planar structures and constructed with National's revolutionary "Epoxy B Concept" for exceptional reliability.

Features

- High V_{CE} ratings
  92PU05, U55 = 60 V min. V_{CEO}
  92PU06, U56 = 80 V min. V_{CEO}
  92PU07, U57 = 100 V min. V_{CEO}
- Exceptional power-to-price ratio

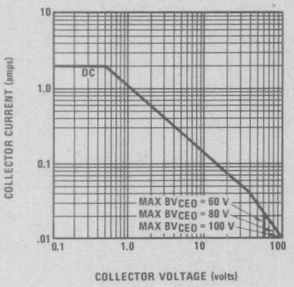
Maximum Ratings

Parameter	Symbol	92PU05 92PU55	92PU06 92PU56	92PU07 92PU57	Units
Collector-Emitter Voltage	V_{CEO}	60	80	100	V_{DC}
Collector-Base Voltage	V_{CB}	60	80	100	V_{DC}
Emitter-Base Voltage	V_{EB}	4.0	4.0	4.0	V_{DC}
Collector Current (cont.)	I_C	2.0	2.0	2.0	A_{DC}
Power Dissipation (T_A = 25°C)	P_{DP}*	1.2	1.2	1.2	W
Temperature	T_j, T_{stg}	-55 to +150	-55 to +150	-55 to +150	°C
Thermal Resistance	θ_{JA}	167	167	167	°C/W
	θ_{JC}	50	50	50	°C/W

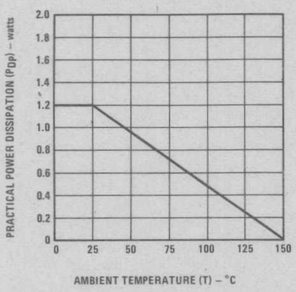
*P_{DP} = Practical Power Dissipation, i.e., that power which can be dissipated with the device installed in a typical manner on a printed circuit board with total copper run area equal to 1.0 in.^{2} minimum.

Typical Performance Characteristics

Safe Operating Area Curve

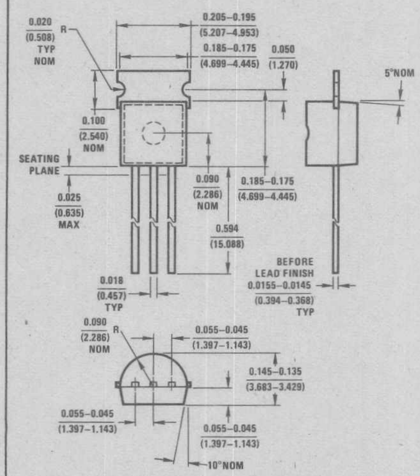


Thermal Derating Curve



Physical Dimensions

92-PLUS



NPN 92PU05 thru 92PU07
PNP 92PU55 thru 92PU57

Electrical Characteristics

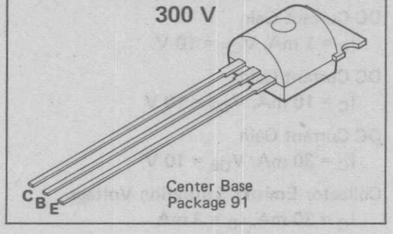
Parameter	Symbol	Min.	Max.	Units
Collector-Emitter Sustaining Voltage	BV_{CEO}			
$I_C = 1.0$ mA, $I_B = 0$				
92PU05, U55		60		V
92PU06, U56		80		V
92PU07, U57		100		V
Collector Cutoff Current	I_{CBO}			
$V_{CB} = 40$ V, $I_E = 0$ 92PU05, U55			0.1	μA
$V_{CB} = 60$ V, $I_E = 0$ 92PU06, U56			0.1	μA
$V_{CB} = 80$ V, $I_E = 0$ 92PU07, U57			0.1	μA
Emitter Cutoff Current	I_{EBO}			
$I_C = 0$, $V_{EB} = 4.0$ V			100	μA
DC Current Gain	h_{FE}			
$I_C = 50$ mA, $V_{CE} = 1.0$ V		80		
$I_C = 250$ mA, $V_{CE} = 1.0$ V		50		
$I_C = 500$ mA, $V_{CE} = 1.0$ V		20		
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$			
$I_C = 250$ mA, $I_B = 10$ mA			0.5	V
$I_C = 250$ mA, $I_B = 25$ mA			0.35	V
Base-Emitter ON Voltage	$V_{BE(on)}$			
$I_C = 250$ mA, $V_{CE} = 1.0$ V			1.2	V
Current Gain Bandwidth Product	f_t			
$I_C = 200$ mA, $V_{CE} = 5$ V, $f = 100$ MHz		50		MHz
Output Capacitance	C_{ob}			
$V_{CB} = 10$ V, $I_E = 0$, $f = 1$ MHz			30	pF

92-PLUS

92PU10

Triple diffused planar structures built with National's revolutionary "Epoxy B Concept." Designed to provide exceptional reliability and performance.

High Voltage
Silicon NPN
Power Transistors
300 V



Center Base
Package 91

Applications

- TV video output
- TV chroma output
- Line operated class "A" audio

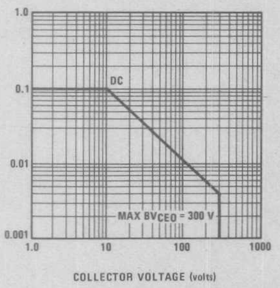
Maximum Ratings

Parameter	Symbol	Rating	Units
Collector-Base Voltage	V_{CB}	300	V_{DC}
Collector-Emitter Voltage	V_{CEO}	300	V_{DC}
Emitter-Base Voltage	V_{EB}	7	V_{DC}
Collector Current (cont.)	I_C	0.1	A_{DC}
Power Dissipation ($T_A = 25°C$)	$*P_{DP}$	1.2	W
Temperature	T_j, T_{stg}	-55 to +150	°C
Thermal Resistance	θ_{JA} θ_{JC}	167 50	°C/W °C/W

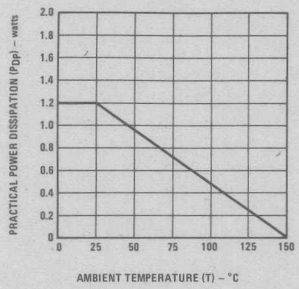
$*P_{DP}$ = Practical Power Dissipation, i.e., that power which can be dissipated with the device installed in a typical manner on a printed circuit board with total copper run area equal to 1.0 in.^{2} minimum.

Typical Performance Characteristics

Safe Operating Area Curve

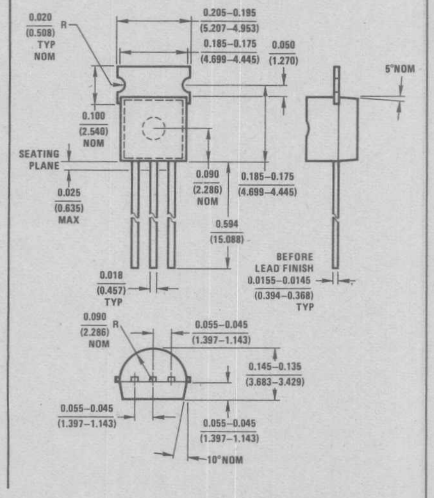


Thermal Derating Curve



Physical Dimensions

92-PLUS



Electrical Characteristics

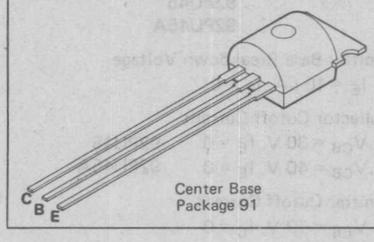
Parameter	Symbol	Min.	Max.	Units
Collector-Emitter Sustaining Voltage $I_C = 1$ mA, $I_B = 0$	BV_{CEO}	300		V_{DC}
Collector Cutoff Current $V_{CB} = 200$ V	I_{CBO}		100	nA
Emitter Cutoff Current $V_{EB} = 6$ V	I_{EBO}		100	nA
DC Current Gain $I_C = 1$ mA, $V_{CE} = 10$ V	h_{FE1}	25		
DC Current Gain $I_C = 10$ mA, $V_{CE} = 10$ V	h_{FE2}	40		
DC Current Gain $I_C = 30$ mA, $V_{CE} = 10$ V	h_{FE3}	40		
Collector-Emitter Saturation Voltage $I_C = 30$ mA, $I_B = 3$ mA	$V_{CE(sat)}$		0.75	V_{DC}
Base-Emitter On Voltage $V_{CE} = 10$ V $I_C = 30$ mA,	$V_{BE(on)}$		0.85	V_{DC}
Collector-Base Junction Capacitance $V_{CB} = 20$ V	C_{cb}		3.5	pF

92-PLUS

92PU45, 92PU45A

Monolithic, double diffused planar power Darlington structures employing National's "Epoxy B" plastic packaging concept for exceptional reliability in amplifier and driver applications.

NPN Silicon Power Darlington 1.0 Watt



Center Base
Package 91

Features

- Lamp driver
- Digit driver
- Directly compatible with bipolar and MOS I/C drive

Maximum Ratings

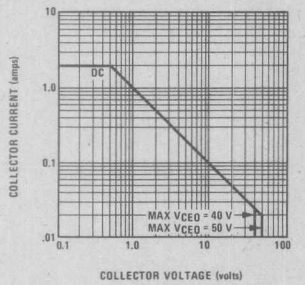
Parameter	Symbol	92PU45	92PU45A	Units
Collector-Emitter Voltage	V_{CES}*	40	50	V_{DC}
Collector-Base Voltage	V_{CB}	50	60	V_{DC}
Emitter-Base Voltage	V_{EB}	12	12	V_{DC}
Collector Current	I_C	2.0	2.0	A_{DC}
Power Dissipation ($T_A = 25°C$)	P_{DP}**	1.0	1.0	W
Temperature	T_j, T_{stg}	-55 to +150	-55 to +150	°C
Thermal Resistance	θ_{JA}	200	200	°C/W
	θ_{JC}	62.5	62.5	°C/W

*V_{CES} for Darlington structure equivalent to V_{CEO} of output xtr.

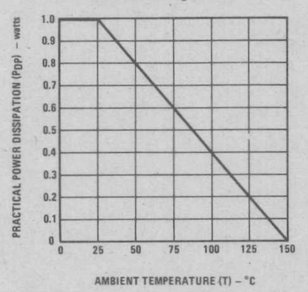
**P_{DP} = Practical Power Dissipation, i.e., that power which can be dissipated with the device installed in a typical manner on a printed circuit board with total copper run area equal to 1.0 in.^{2} minimum.

Typical Performance Characteristics

Safe Operating Area Curve

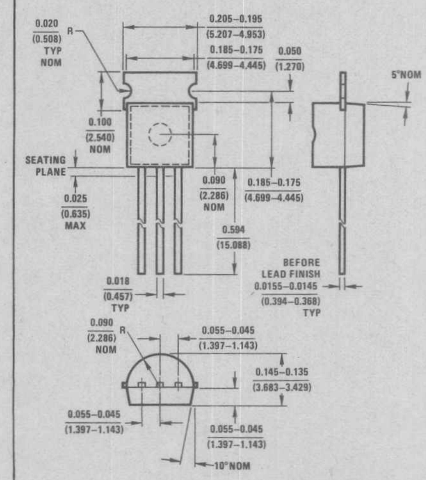


Thermal Derating Curve



Physical Dimensions

92-PLUS



92PU45, 92PU45A

1

$I_C = 1.0$ mA, $V_{BE} = 0$				
92PU45		40		V_{DC}
92PU45A		50		V_{DC}
Collector-Base Breakdown Voltage	BV_{CBO}			
$I_C = 100\ \mu A$, $I_E = 0$				
92PU45		50		V_{DC}
92PU45A		60		V_{DC}
Emitter-Base Breakdown Voltage	BV_{EBO}			
$I_E = 10\ \mu A$, $I_C = 0$		12		V_{DC}
Collector Cutoff Current	I_{CBO}			
$V_{CB} = 30$ V, $I_E = 0$ 92PU45			100	NA
$V_{CB} = 40$ V, $I_E = 0$ 92PU45A			100	NA
Emitter Cutoff Current	I_{EBO}			
$V_{EB} = 10$ V, $I_C = 0$			100	μA
DC Current Gain	h_{FE}			
$I_C = 200$ mA, $V_{CE} = 5.0$ V		25,000		
$I_C = 500$ mA, $V_{CE} = 5.0$ V		15,000		
$I_C = 1000$ mA, $V_{CE} = 5.0$ V		4,000		
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$			
$I_C = 1000$ mA, $I_B = 2$ mA			1.5	V_{DC}
$I_C = 200$ mA, $I_B = 2$ mA			1.0	V_{DC}
Base-Emitter Saturation Voltage	$V_{BE(sat)}$			
$I_C = 1000$ mA, $I_B = 2$ mA			2.0	V_{DC}
Base-Emitter ON Voltage	$V_{BE(on)}$			
$I_C = 1000$ mA, $V_{CE} = 5$ V			2.0	V_{DC}
Small Signal Current Gain	$\lvert h_{FE} \rvert$			
$I_C = 200$ mA, $V_{CE} = 5.0$ V, f = 100 MHz		1.0		

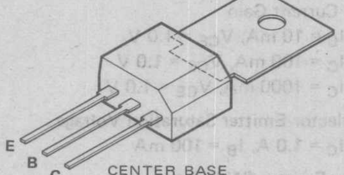
Section 2

TO-202

2

Complementary plastic power transistors employing double diffused planar structures and constructed with National's revolutionary "Epoxy B" concept for exceptional performance and reliability.

Complementary NPN/PNP Silicon Audio Power Transistors 10.0 Watts



CENTER BASE
Package 35

Applications

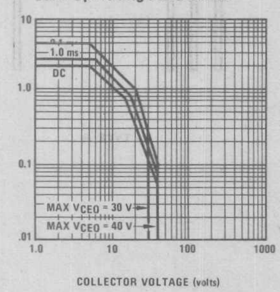
- Class B audio outputs/drivers
- General purpose switching and lamp drive in industrial and automotive circuits.

Maximum Ratings

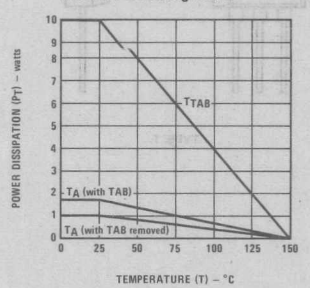
		NSDU01	NSDU01A	
Collector-Emitter Voltage	V_{CEO}	30	40	V
Collector-Base Voltage	V_{CB}	40	50	V
Emitter-Base Voltage	V_{EB}	5.0	5.0	V
Collector Current (cont.)	I_C	2.0	2.0	A
Power Dissipation ($T_A = 25°C$)	P_D	1.75	1.75	W
($T_C = 25°C$)		10	10	W
Temperature	T_j, T_{stg}	-55 to +150	-55 to +150	°C
Thermal Resistance	θ_{JA}	71.4	71.4	°C/W
	θ_{JC}	12.5	12.5	°C/W

Typical Performance Characteristics

Safe Operating Area Curve

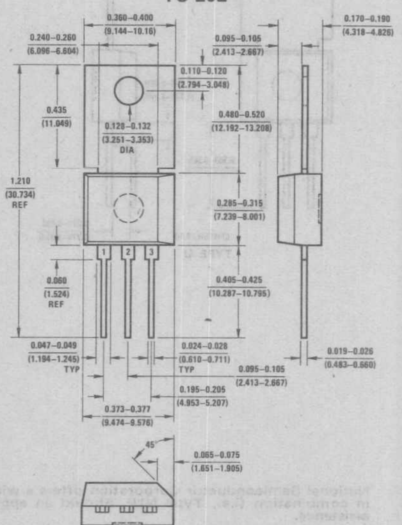


Thermal Derating Curve



Physical Dimensions

TO-202

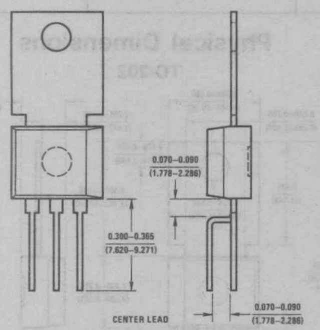


Electrical Characteristics

Parameter	Symbol	Min.	Max.	Units
Collector-Emitter Sustaining Voltage	BV_{CEO}			
$I_C = 10$ mA, $I_B = 0$				
NSDU01, U51		30		V
NSDU01A, U51A		40		V
Collector Cutoff Current	I_{CBO}			
$V_{CB} = 30$ V, $I_E = 0$ NSDU01, NSDU51			0.1	μA
$V_{CB} = 40$ V, $I_E = 0$ NSDU01A, NSDU51A			0.1	μA
Emitter Cutoff Current				
$V_{EB} = 5.0$ V, $I_C = 0$			0.1	μA
DC Current Gain	h_{FE}			
$I_C = 10$ mA, $V_{CE} = 1.0$ V		55		
$I_C = 100$ mA, $V_{CE} = 1.0$ V		60		
$I_C = 1000$ mA, $V_{CE} = 1.0$ V		50		
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$			
$I_C = 1.0$ A, $I_B = 100$ mA			0.5	V
Base-Emitter ON Voltage	$V_{BE(on)}$			
$I_C = 1.0$ A, $V_{CE} = 1.0$ V			1.2	V
Current-Gain Bandwidth Product	f_t			
$I_C = 50$ mA, $V_{CE} = 10$ V, f = 20 MHz		50		MHz
Output Capacitance	C_{ob}			
$V_{CB} = 10$ V, $I_E = 0$, f = 1 MHz			30	pF

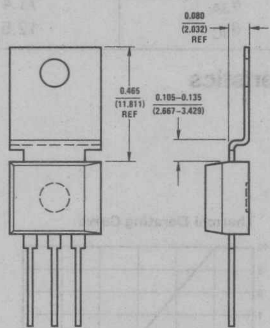
Physical Dimensions

TO-5 Equivalent



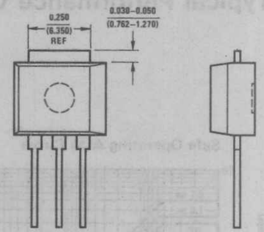
TYPE U

Flush Mounting



TYPE T

Sheared Tab



TYPE N

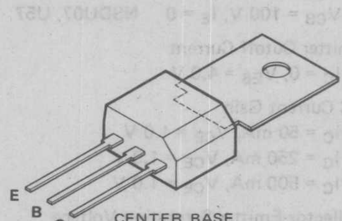
National Semiconductor Corporation offers a wide variety of tab/lead configurations. These standard types may be ordered as shown or in combination (i.e., Type NU). Should an application require a configuration not shown, contact your NS sales representative for assistance.

POWER TRANSISTORS

NPN NSDU05 thru NSDU07
PNP NSDU55 thru NSDU57

Complementary plastic power transistors employing double diffused planar structures and constructed with National's Revolutionary "Epoxy B" concept for exceptional reliability.

Complementary NPN/PNP Audio Power Transistors



CENTER BASE
Package 35

Applications

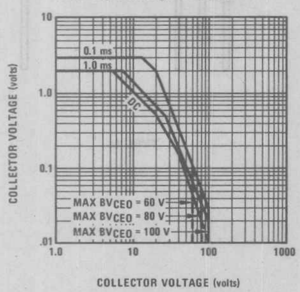
- High V_{CE} ratings
  NSDU05, U55 = 60 V min. V_{CEO}
  NSDU06, U56 = 80 V min. V_{CEO}
  NSDU07, U57 = 100 V min. V_{CEO}
- Exceptional power dissipation capability:
  P_D = 1.75 Watts @ T_A = 25 C

Maximum Ratings

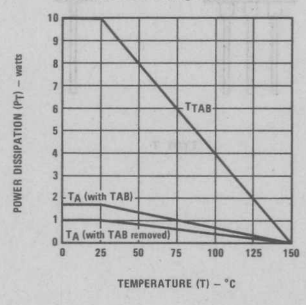
Parameter	Symbol	NSDU05 NSDU55	NSDU06 NSDU56	NSDU07 NSDU57	Units
Collector-Emitter Voltage	V_{CEO}	60	80	100	V_{DC}
Collector-Base Voltage	V_{CB}	60	80	100	V_{DC}
Emitter-Base Voltage	V_{EB}	4.0	4.0	4.0	V_{DC}
Collector Current (cont.)	I_C	2.0	2.0	2.0	A_{DC}
Power Dissipation (T_A = 25°C)	P_D	1.75	1.75	1.75	W
(T_C = 25°C)		10	10	10	W
Temperature	T_j, T_{stg}	-55 to +150	-55 to +150	-55 to +150	°C
Thermal Resistance	θ_{JA}	71.4	71.4	71.4	°C/W
	θ_{JC}	12.5	12.5	12.5	°C/W

Typical Performance Characteristics

Safe Operating Area Curve

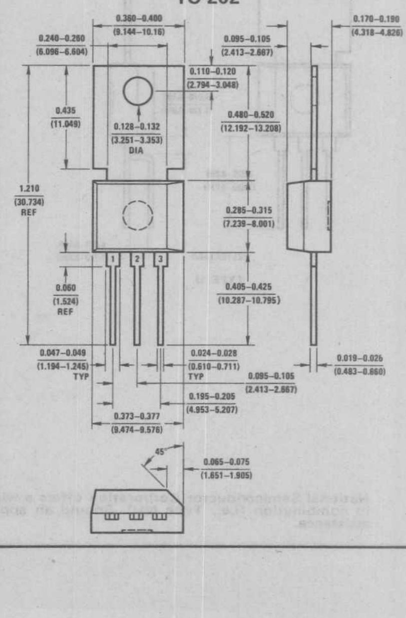


Thermal Derating Curve



Physical Dimensions

TO-202

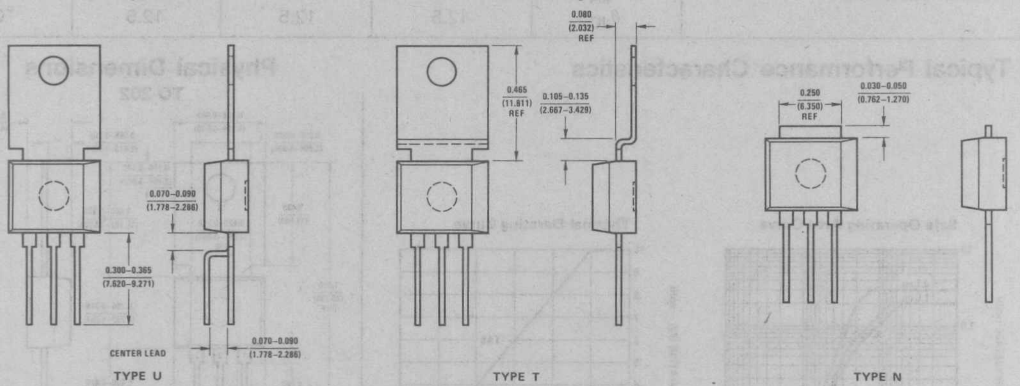


Electrical Characteristics

Parameter	Symbol	Min.	Max.	Units
Collector-Emitter Sustaining Voltage	BV_{CEO}			
$I_C = 1.0$ mA, $I_B = 0$				
NSDU05, U55		60		V
NSDU06, U56		80		V
NSDU07, U57		100		V
Collector Cutoff Current	I_{CBO}			
$V_{CB} = 60$ V, $I_E = 0$ NSDU05, U55			0.1	μA
$V_{CB} = 80$ V, $I_E = 0$ NSDU06, U56			0.1	μA
$V_{CB} = 100$ V, $I_E = 0$ NSDU07, U57			0.1	μA
Emitter Cutoff Current	I_{EBO}			
$I_C = 0$, $V_{EB} = 4.0$ V			100	μA
DC Current Gain	h_{FE}			
$I_C = 50$ mA, $V_{CE} = 1.0$ V		80		
$I_C = 250$ mA, $V_{CE} = 1.0$ V		50		
$I_C = 500$ mA, $V_{CE} = 1.0$ V		20		
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$			
$I_C = 250$ mA, $I_B = 10$ mA			0.5	V
$I_C = 250$ mA, $I_B = 25$ mA			0.35	V
Base-Emitter ON Voltage	$V_{BE(on)}$			
$I_C = 250$ mA, $V_{CE} = 1.0$ V			1.2	V
Current Gain Bandwidth Product	f_t			
$I_C = 200$ mA, $V_{CE} = 5$ V, f = 100 MHz		50		MHz
Output Capacitance	C_{ob}			
$V_{CB} = 10$ V, $I_E = 0$, f = 1 MHz			30	pF

Physical Dimensions

TO-5 Equivalent | Flush Mounting | Sheared Tab



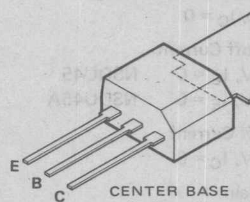
National Semiconductor Corporation offers a wide variety of tab/lead configurations. These standard types may be ordered as shown or in combination (i.e., Type NU). Should an application require a configuration not shown, contact your NS sales representative for assistance.

POWER TRANSISTORS

NSDU45, NSDU45A

Monolithic, double diffused planar power Darlington structures employing National's "Epoxy B" plastic packaging concept for exceptional reliability in amplifier and driver applications.

NPN Silicon
Power Darlington
10.0 Watts



CENTER BASE
Package 35

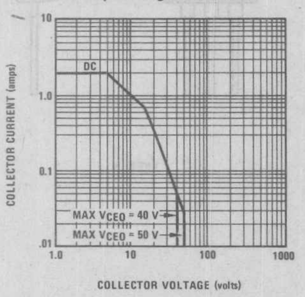
Maximum Ratings

Parameter	Symbol	NSDU45	NSDU45A	Units
Collector-Emitter Voltage	V_{CES}*	40	50	V_{DC}
Collector-Base Voltage	V_{CB}	50	60	V_{DC}
Emitter-Base Voltage	V_{EB}	12	12	V_{DC}
Collector Current	I_C	2.0	2.0	A_{DC}
Power Dissipation ($T_A = 25°C$)	P_D	1.75	1.75	W
($T_C = 25°C$)		10	10	W
Temperature	T_j, T_{stg}	-55 to +150	-55 to +150	°C
Thermal Resistance	θ_{JA}	71.4	71.4	°C/W
	θ_{JC}	12.5	12.5	°C/W

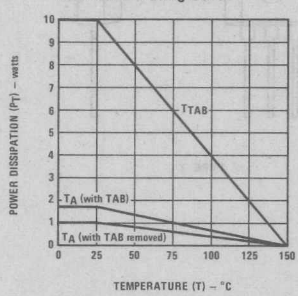
* V_{CES} for Darlington structure equivalent to V_{CEO} of output xtr.

Typical Performance Characteristics

Safe Operating Area Curve

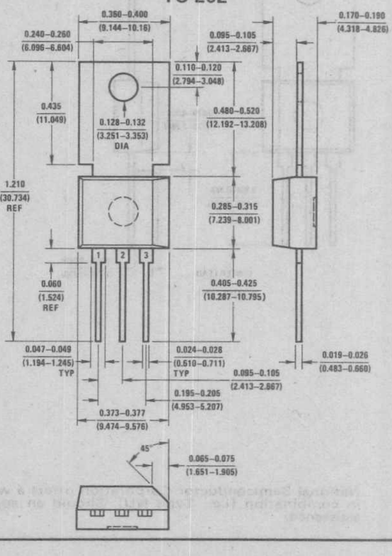


Thermal Derating Curve



Physical Dimensions

TO-202

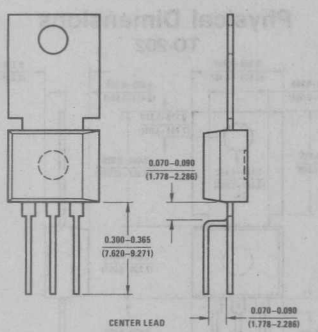


Electrical Characteristics

Parameter	Symbol	Min.	Max.	Units
Collector-Emitter Breakdown Voltage	BV_{CES}			
$I_C = 1.0$ mA, $V_{BE} = 0$				
NSDU45		40		V_{DC}
NSDU45A		50		V_{DC}
Collector-Base Breakdown Voltage	BV_{CBO}			
$I_C = 100\ \mu A$, $I_E = 0$				
NSDU45		50		V_{DC}
NSDU45A		60		V_{DC}
Emitter-Base Breakdown Voltage	BV_{EBO}			
$I_E = 10\ \mu A$, $I_C = 0$		12		V_{DC}
Collector Cutoff Current	I_{CBO}			
$V_{CB} = 30$ V, $I_E = 0$ NSDU45			0.1	μA
$V_{CB} = 40$ V, $I_E = 0$ NSDU45A			0.1	μA
Emitter Cutoff Current	I_{EBO}			
$V_{EB} = 10$ V, $I_C = 0$			100	μA
DC Current Gain	h_{FE}			
$I_C = 200$ mA, $V_{CE} = 5.0$ V		25,000	150,000	
$I_C = 500$ mA, $V_{CE} = 5.0$ V		15,000		
$I_C = 1000$ mA, $V_{CE} = 5.0$ V		4,000		
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$			
$I_C = 1000$ mA, $I_B = 2$ mA			1.5	V_{DC}
$I_C = 200$ mA, $I_B = 2$ mA			1.0	V_{DC}
Base-Emitter Saturation Voltage	$V_{BE(sat)}$			
$I_C = 1000$ mA, $I_B = 2$ mA			2.0	V_{DC}
Base-Emitter ON Voltage	$V_{BE(on)}$			
$I_C = 1000$ mA, $V_{CE} = 5$ V			2.0	V_{DC}
Small Signal Current Gain	$\lvert h_{FE} \rvert$			
$I_C = 200$ mA, $V_{CE} = 5.0$ V, f = 100 MHz		1.0		

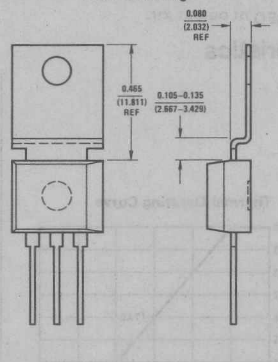
Physical Dimensions

TO-5 Equivalent



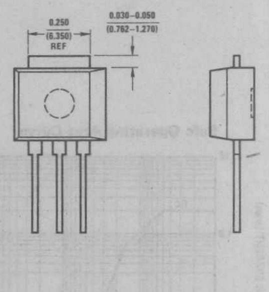
TYPE U

Flush Mounting



TYPE T

Sheared Tab



TYPE N

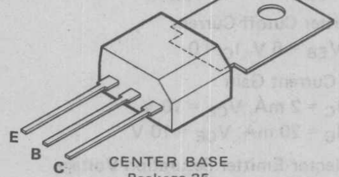
National Semiconductor Corporation offers a wide variety of tab/lead configurations. These standard types may be ordered as shown or in combination (i.e., Type NU). Should an application require a configuration not shown, contact your NS sales representative for assistance.

POWER TRANSISTORS

NSD3439, NSD3440

NPN Silicon power transistors designed to economically replace the popular 2N3439/2N3440. These plastic packaged, triple diffused, planar devices incorporate National's revolutionary "Epoxy B" concept to provide exceptional reliability.

NPN Silicon Power Transistors 250 - 350 Volts



CENTER BASE
Package 35

Applications

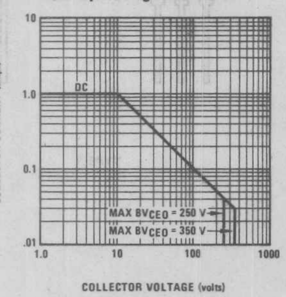
- Audio, video and differential amplifiers
- High voltage, low current inverters
- Switching and series pass regulators

Maximum Ratings

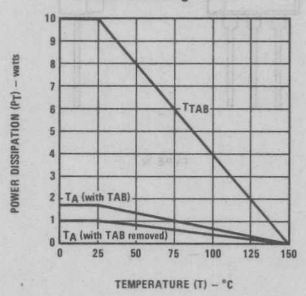
Parameter	Symbol	NSD3439	NSD3440	Units
Collector-Emitter Voltage	V_{CEO}	350	250	V
Collector-Base Voltage	V_{CB}	450	300	V
Emitter-Base Voltage	V_{EB}	7	7	V
Collector Current (cont.)	I_C	1	1	A
Power Dissipation ($T_A = 25°C$)	P_D	1.75	1.75	W
($T_C = 25°C$)		10.0	10.0	W
Temperature	T_j, T_{stg}	-55 to +150	-55 to +150	°C

Typical Performance Characteristics

Safe Operating Area Curve

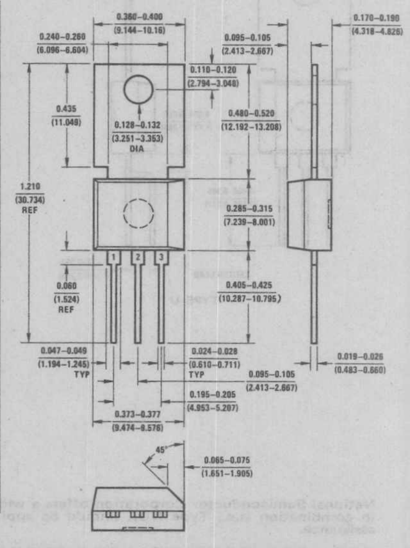


Thermal Derating Curve



Physical Dimensions

TO-202

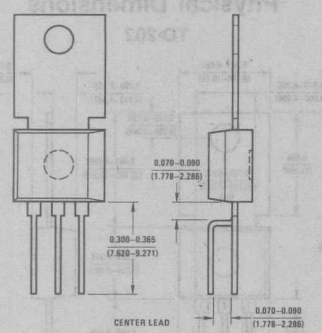


2

Collector-Emitter Sustaining Voltage		BV_{CEO}			
I_C = 10 mA					
	3439		350		V
	3440		250		V
Collector Cutoff Current		I_{CEO}			
V_{CE} = 300 V, I_B = 0	3439			20	μA
V_{CE} = 2-- V, I_B = 0	3440			50	μA
Collector Cutoff Current		I_{CEX}			
V_{CE} = 450 V, $V_{BE(off)}$ = 1.5 V	3439			500	μA
V_{CE} = 300 V, $V_{BE(off)}$ = 1.5 V	3440			500	μA
Emitter Cutoff Current		I_{EBO}			
V_{EB} = 6 V, I_C = 0				20	μA
DC Current Gain		h_{FE}			
I_C = 2 mA, V_{CE} = 10 V			30		
I_C = 20 mA, V_{CE} = 10 V			40	160	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$			
I_C = 50 mA, I_B = 10 mA				0.5	V
Base-Emitter Saturation Voltage		$V_{BE(sat)}$			
I_C = 50 mA, I_B = 10 mA				1.3	V
Gain-Bandwidth Product		f_t			
I_C = 10 mA, V_{CE} = 10 V			15		MHz
Output Capacitance		C_{ob}			
V_{CB} = 10 V, I_E = 0, f = 1 MHz				20	pF
Input Capacitance		C_{ib}			
V_{EB} = 5 V, I_C = 0, f = 1 MHz				75	pF

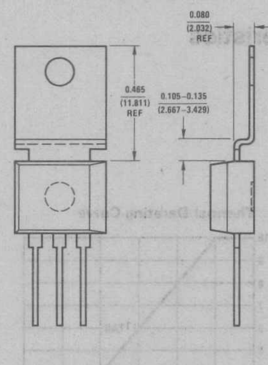
Physical Dimensions

TO-5 Equivalent



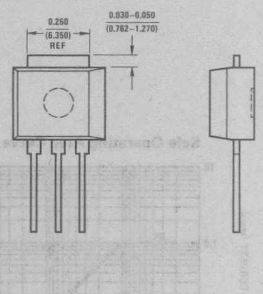
TYPE U

Sheared Tab



TYPE N

Flush Mounting



TYPE T

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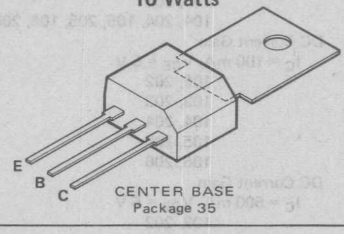
POWER TRANSISTORS

NPN NSD102 thru NSD106
PNP NSD202 thru NSD206

Complementary plastic power transistors designed for medium power applications in consumer and industrial sockets. These products feature planar double diffused structures packaged using National's revolutionary "Epoxy B" concept to provide exceptional performance and reliability.

Complementary NPN/PNP Silicon Power Transistors 10 Watts



CENTER BASE
Package 35

Applications

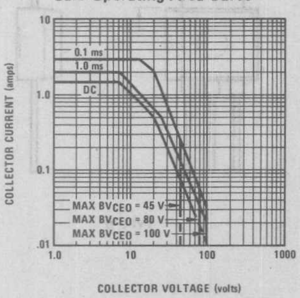
- Low level audio outputs and drivers
- General purpose switching

Maximum Ratings

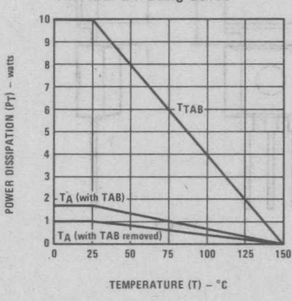
Parameter	Symbol	NSD102, 103 NSD202, 203	NSD104, 105 NSD204, 205	NSD106 NSD206	Units
Collector-Emitter Voltage	V_{CEO}	45	80	100	V_{DC}
Collector-Base Voltage	V_{CB}	60	100	140	V_{DC}
Emitter-Base Voltage	V_{EB}	5	7	7	V_{DC}
Collector Current (cont.)	I_C	1.5	1.0	1.0	A_{DC}
Power Dissipation ($T_A = 25°C$)	P_D	1.75	1.75	1.75	W
($T_C = 25°C$)		10	10	10	W
Temperature	T_j, T_{stg}	-55 to +150	-55 to +150	-55 to +150	°C
Thermal Resistance	θ_{JA}	71.4	71.4	71.4	°C/W
	θ_{JC}	12.5	12.5	12.5	°C/W

Typical Performance Characteristics

Safe Operating Area Curve

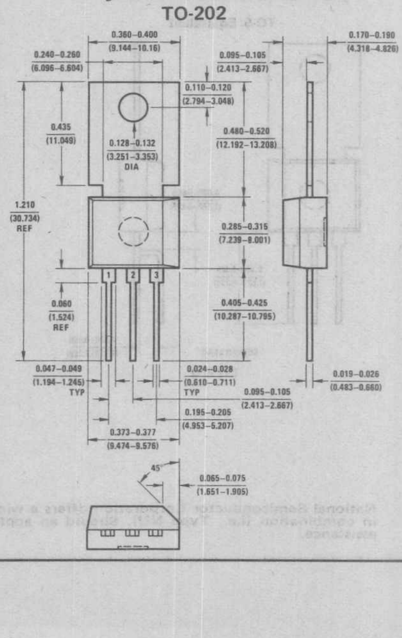


Thermal Derating Curve



Physical Dimensions

TO-202

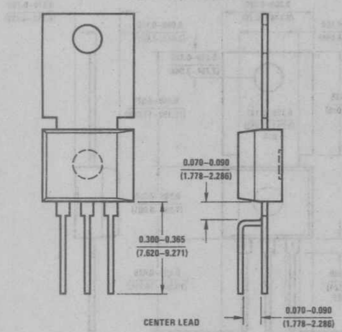


Electrical Characteristics

Parameter	Symbol	Min.	Max.	Units
Collector-Emitter Sustaining Voltage	BV_{CEO}			
I_C = 10 mA, I_B = 0				
102, 202, 103, 203		45		V_{DC}
104, 204, 105, 205		80		V_{DC}
106, 206		100		V_{DC}
Collector Cutoff Current	I_{CBO}			
V_{CB} = rated			0.1	μA
Emitter Cutoff Current	I_{EBO}			
V_{EB} = rated			0.1	μA
DC Current Gain	h_{FE1}			
I_C = 10 mA, V_{CE} = 5 V				
102, 202		40		
103, 203		50		
104, 204, 105, 205, 106, 206		20		
DC Current Gain	h_{FE2}			
I_C = 100 mA, V_{CE} = 5 V				
102, 202		50	150	
103, 203		120	360	
104, 204		50	150	
105, 205		120	360	
106, 206		50	150	
DC Current Gain	h_{FE3}			
I_C = 500 mA, V_{CE} = 5 V				
102, 202		40		
103, 203		50		
106, 206		25		
DC Current Gain	h_{FE4}			
I_C = 1000 mA, V_{CE} = 5 V				
102, 202		25		
103, 203		30		
104, 204, 105, 205		10		
Collector-Emitter Saturation Voltage	$V_{CE(sat)1}$			
I_C = 100 mA, I_B = 10 mA			0.2	V_{DC}
Collector-Emitter Saturation Voltage	$V_{CE(sat)2}$			
I_C = 500 mA, I_B = 50 mA				
102, 103, 202, 203			0.4	V_{DC}
104, 105, 106, 204, 205, 206			0.5	V_{DC}
Base-Emitter Saturation Voltage	$V_{BE(sat)}$			
I_C = 100 mA, I_B = 10 mA			0.9	V_{DC}
I_C = 500 mA, I_B = 50 mA			1.2	V_{DC}
Collector Output Capacitance	C_{ob}			
V_{CB} = 10 V			30	pF
Gain Bandwidth Product	f_t			
I_C = 50 mA, V_{CE} = 10 V, f = 10 MHz		60		MHz

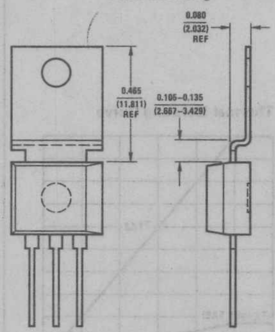
Physical Dimensions

TO-5 Equivalent



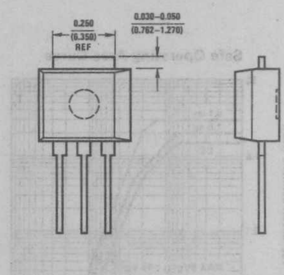
TYPE U

Flush Mounting



TYPE T

Sheared Tab



TYPE N

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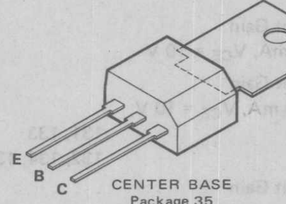
POWER TRANSISTORS

NSD131 thru NSD135

Triple diffused planar structures built with National's revolutionary "Epoxy B" concept. Designed to provide exceptional reliability and performance.

High Voltage
Silicon NPN
Power Transistors
250 - 375 V



CENTER BASE
Package 35

Applications

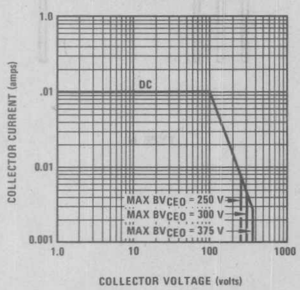
- TV video output
- TV chroma output
- Line operated class "A" audio

Maximum Ratings

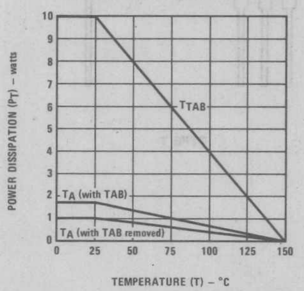
Parameter	Symbol	NSD131 NSD132	NSD133 NSD134	NSD135	Units
Collector-Base Voltage	V_{CB}	250	300	375	V_{DC}
Collector-Emitter Voltage	V_{CEO}	250	300	375	V_{DC}
Emitter-Base Voltage	V_{EB}	7	7	7	V_{DC}
Collector Current (cont.)	I_C	0.1	0.1	0.1	A_{DC}
Power Dissipation ($T_A = 25°C$)	P_D	1.75	1.75	1.75	W
($T_C = 25°C$)		10	10	10	W
Temperature	T_j, T_{stg}	-55 to +150	-55 to +150	-55 to +150	°C
Thermal Resistance	θ_{JA}	71.4	71.4	71.4	°C/W
	θ_{JC}	12.5	12.5	12.5	°C/W

Typical Performance Characteristics

Safe Operating Area Curve

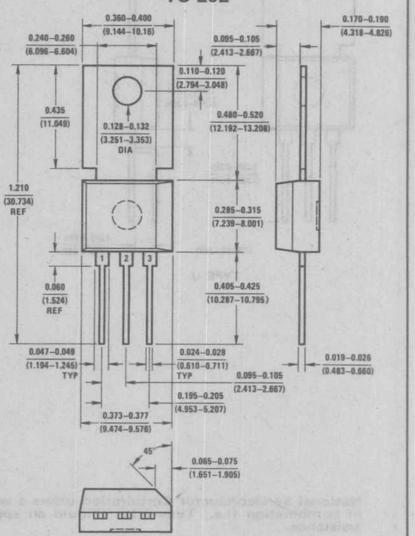


Thermal Derating Curve



Physical Dimensions

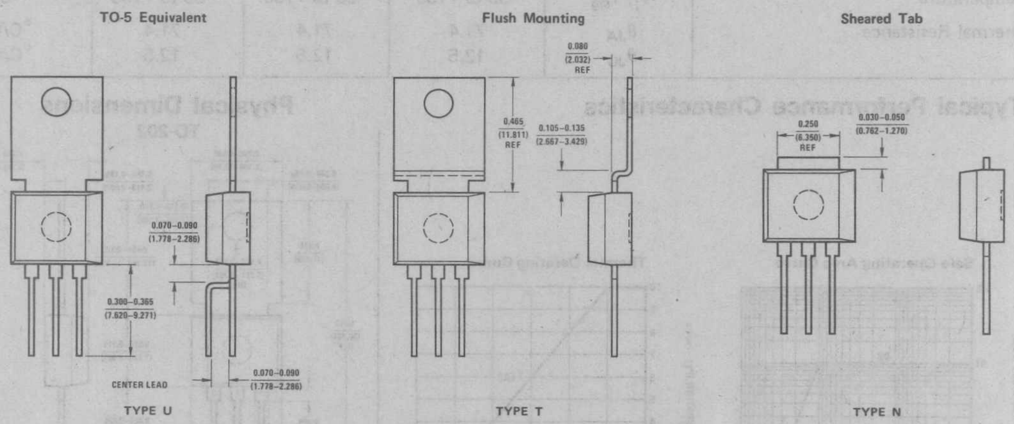
TO-202



Electrical Characteristics

Parameter	Symbol	Min.	Max.	Units
Collector-Emitter Sustaining Voltage	BV_{CEO}			
$I_C = 5$ mA, $I_B = 0$				
131, 132		250		V_{DC}
133, 134		300		V_{DC}
135		375		V_{DC}
Collector Cutoff Current	I_{CBO}			
$V_{CB} = 150$ V			100	μA
Emitter Cutoff Current	I_{EBO}			
$V_{EB} = 6$ V			100	μA
DC Current Gain	h_{FE_1}			
$I_C = 1$ mA, $V_{CE} = 10$ V		15		
DC Current Gain	h_{FE_2}			
$I_C = 10$ mA, $V_{CE} = 10$ V				
131, 133		15		
132, 134, 135		30		
DC Current Gain	h_{FE_3}			
$I_C = 30$ mA, $V_{CE} = 10$ V				
131, 133, 135		30	90	
132, 134		60	180	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$			
$I_C = 20$ mA, $I_B = 2$ mA			1.0	V_{DC}
Emitter-Base Saturation Voltage	$V_{BE(sat)}$			
$I_C = 20$ mA, $I_B = 2$ mA			0.85	V_{DC}
Collector-Base Junction Capacitance	C_{cb}			
$V_{CB} = 20$ V			3.0	pF

Physical Dimensions



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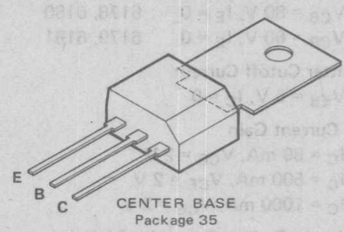
POWER TRANSISTORS

NPN NSD6178, NSD6179 PNP NSD6180, NSD6181

Complementary double diffused planar transistors designed and manufactured with National's revolutionary "Epoxy B" concept. These devices are designed to replace the 2N2102, 2N6178, 2N6179 and the 2N4036, 2N6180, 2N6181 while providing superior reliability and free air power handling capability.

Silicon Complementary NPN/PNP Power Transistors 2 Amperes



Package 35

Applications

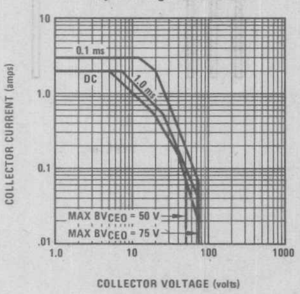
- Audio driver and output pairs
- Industrial switches
- Inverters/converters

Maximum Ratings

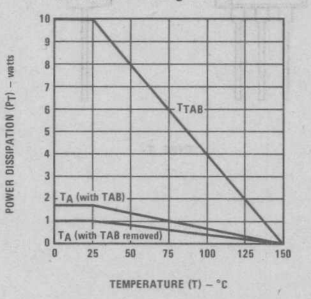
Parameter	Symbol	NSD6178 NSD6180	NSD6179 NSD6181	Units
Collector-Base Voltage	V_{CB}	100	75	V
Collector-Emitter Voltage	V_{CEO}	75	50	V
Emitter-Base Voltage	V_{EB}	5	5	V
Collector Current	I_C	2	2	A
Power Dissipation ($T_A = 25°C$)	P_D	1.75	1.75	W
($T_C = 25°C$)		10.0	10.0	W
Temperature	T_j, T_{stg}	-55 to +150	-55 to +150	°C

Typical Performance Characteristics

Safe Operating Area Curve

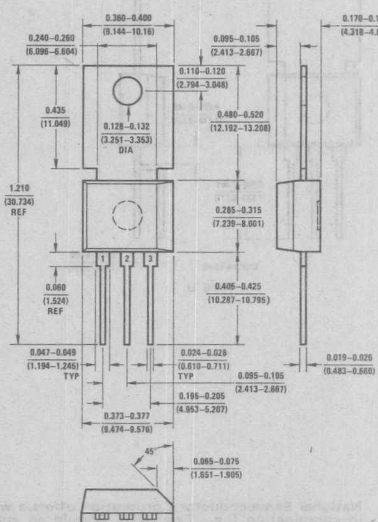


Thermal Derating Curve



Physical Dimensions

TO-202



NPN NSD6178, NSD6179 PNP NSD6180, NSD6181

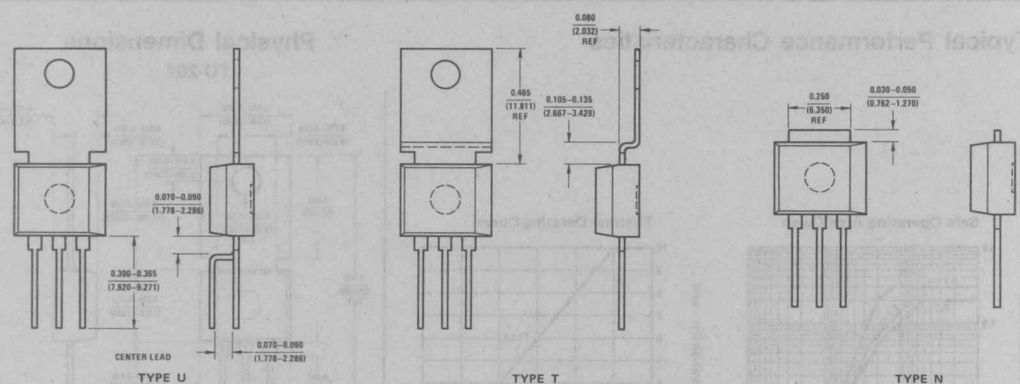
2

Electrical Characteristics

Parameter	Symbol	Min.	Max.	Units
Collector-Emitter Sustaining Voltage	BV_{CEO}			
$I_C = 10$ mA				
6178, 6180		75		V
6179, 6181		50		V
Collector Cutoff Current	I_{CEO}			
$V_{CE} = 60$ V, $I_B = 0$ 6178, 6180			1.0	mA
$V_{CE} = 45$ V, $I_B = 0$ 6179, 6181			1.0	mA
Collector Cutoff Current	I_{CBO}			
$V_{CB} = 80$ V, $I_E = 0$ 6178, 6180			0.5	mA
$V_{CB} = 60$ V, $I_E = 0$ 6179, 6181			0.5	mA
Emitter Cutoff Current	I_{EBO}			
$V_{EB} = 5$ V, $I_C = 0$			0.1	mA
DC Current Gain	h_{FE}			
$I_C = 50$ mA, $V_{CE} = 2$ V		30		
$I_C = 500$ mA, $V_{CE} = 2$ V		40	250	
$I_C = 1000$ mA, $V_{CE} = 2$ V		10		
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$			
$I_C = 500$ mA, $I_B = 50$ mA			0.5	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$			
$I_C = 500$ mA, $I_B = 50$ mA			1.2	V
Output Capacitance	C_{ob}			
$V_{CB} = 10$ V, f = 1 MHz			30	pF
Gain Bandwidth Product	f_t			
$V_{CE} = 4$ V, $I_C = 50$ mA		50		MHz
Second Breakdown Collector Current	$I_{S/B}$			
$V_{CE} = 50$ V, t = 1.0 s		70		mA

Physical Dimensions

TO-5 Equivalent | Flush Mounting | Sheared Tab



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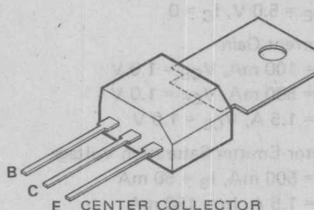
POWER TRANSISTORS

NPN NSE180, NSE181
PNP NSE170, NSE171

Double diffused planar power transistors designed with National's revolutionary "Epoxy B" concept to provide exceptional reliability.

Complementary Silicon Power Transistors 10.0 Watts



Package 36

Applications

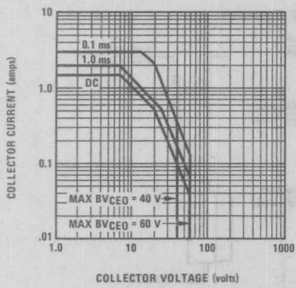
- Audio output and/or driver
- High frequency inverters/converters
- Series, shunt and switching regulators

Maximum Ratings

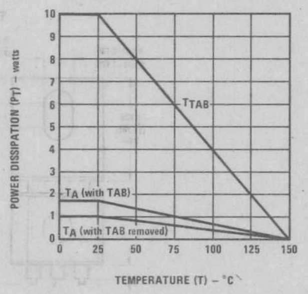
Parameter	Symbol	NSE180 NSE170	NSE181 NSE171	Units
Collector-Base Voltage	V_{CB}	60	80	V
Collector-Emitter Voltage	V_{CEO}	40	60	V
Emitter-Base Voltage	V_{EB}	5	5	V
Collector Current	I_C	3	3	A
Power Dissipation ($T_A = 25°C$)	T_j, T_{stg}	1.75	1.75	W
($T_C = 25°C$)		10.0	10.0	W
Temperature	T_j, T_{stg}	-55 to +150	-55 to +150	°C
Thermal Resistance	θ_{JA}	71.4	71.4	°C/W
	θ_{JC}	12.5	12.5	°C/W

Typical Performance Characteristics

Safe Operating Area Curve

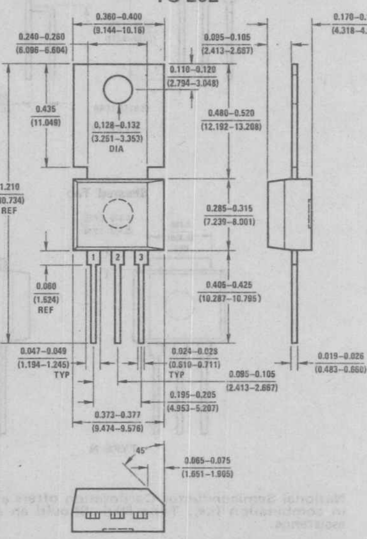


Thermal Derating Curve



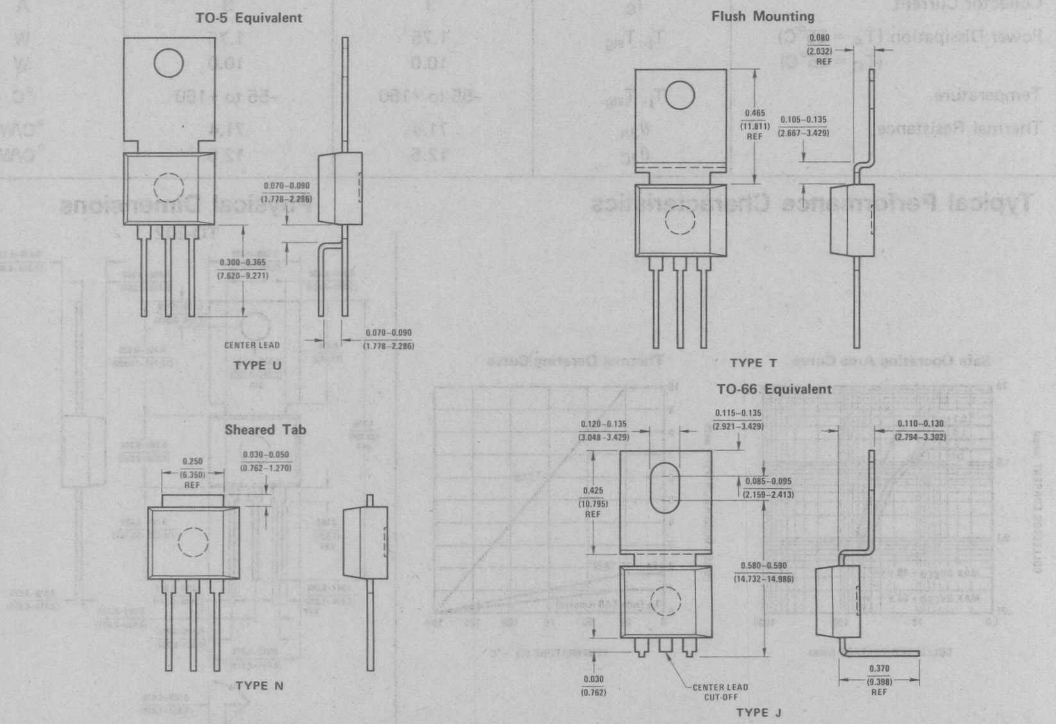
Physical Dimensions

TO-202



NSE170, 180		40		V
NSE171, 181		60		V
Collector Cutoff Current	I_{CBO}			
V_{CB} = 60 V, I_E = 0 NSE170, 180			0.1	μA
V_{CB} = 80 V, I_E = 0 NSE171, 181			0.1	μA
Emitter Cutoff Current	I_{EBO}			
V_{BE} = 5.0 V, I_C = 0			0.1	μA
DC Current Gain	h_{FE}			
I_C = 100 mA, V_{CE} = 1.0 V		50	250	
I_C = 500 mA, V_{CE} = 1.0 V		30		
I_C = 1.5 A, V_{CE} = 1.0 V		12		
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$			
I_C = 500 mA, I_B = 50 mA			0.3	V
I_C = 1.5 A, I_B = 150 mA			0.9	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$			
I_C = 1.5 A, I_B = 150 mA			1.5	V
Base-Emitter ON Voltage	$V_{BE(on)}$			
I_C = 500 mA, V_{CE} = 1.0 V			1.2	V
Gain Bandwidth Product	f_t			
I_C = 100 mA, V_{CE} = 10 V, f = 10 MHz		50		MHz

Physical Dimensions



National Semiconductor Corporation offers a wide variety of tab/lead configurations. These standard types may be ordered as shown or in combination (i.e., Type NU). Should an application require a configuration not shown, contact your NS sales representative for assistance.

Section 3

TO-220

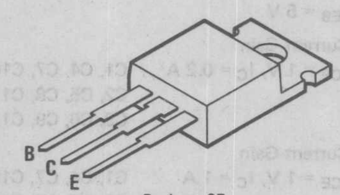
3

POWER TRANSISTORS

NPN D44C1 thru D44C12 PNP D45C1 thru D45C12

NPN/PNP Complementary Silicon Power Transistors employing Epi-Base Mesa Technology for ideal performance in a variety of general purpose power and switching applications:

Complementary Silicon Power Transistors 30 Watts/ 4 Amps



Package 37
TO-220

Applications

- Audio Amplifiers
- Series, Shunt, Switching Regulators
- Inverters/Converters

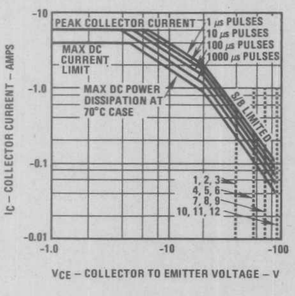
These devices are designed and manufactured using National's "Epoxy B Concept." They feature exceptional reliability and are especially suitable for applications involving repeated on-off operation where wide temperature excursions are anticipated.

Maximum Ratings

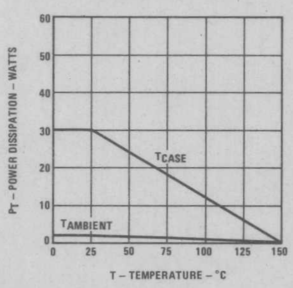
Parameter	Symbol	C1, C2, C3	C4, C5, C6	C7, C8, C9	C10, C11, C12	Units
Collector-Base Voltage	V_{CB}	40	55	70	90	V
Collector-Emitter Voltage	V_{CEO}	30	45	60	80	V
Emitter-Base Voltage	V_{EB}	5				V
Collector Current (continuous)	I_C	4				A
(peak)		6				
Power Dissipation ($T_C = 25°C$)		30				W
($T_A = 25°C$)		2				
Thermal Resistance	θ_{JC}	4.16				°C/W
	θ_{JA}	62.5				
Temperature Range	T_J, T_{STG}	-65 to +150				°C

Typical Performance Characteristics

Safe Operating Area Curve

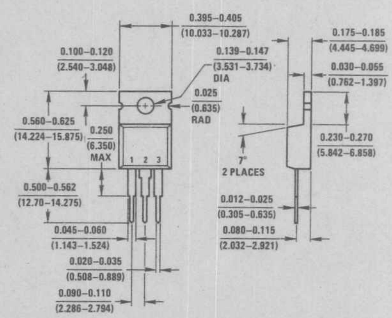


Thermal Derating Curve



Physical Dimensions

TO-220



NPN D44C1 thru D44C12
PNP D45C1 thru D45C12

Electrical Characteristics ($T_C = 25^\circ C$ unless noted)

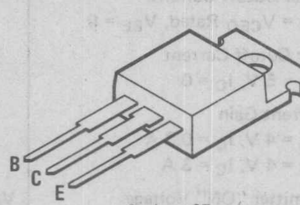
Parameter		Symbol	Min.	Max.	Units
Collector-Emitter Sustaining Voltage		V_{CEO}			V
$I_C = 100$ mA, $I_B = 0$	C1, C2, C3		30		
	C4, C5, C6		45		
	C7, C8, C9		60		
	C10, C11, C12		80		
Collector Cutoff Current		I_{CES}			μA
$V_{CE} = V_{CB}$ Rated, $V_{EB} = 0$				10	
Emitter Cutoff Current		I_{EBO}			μA
$V_{EB} = 5$ V				100	
DC Current Gain		h_{FE1}			
$V_{CE} = 1$ V, $I_C = 0.2$ A	C1, C4, C7, C10		25	–	
	C2, C5, C8, C11		40	120	
	C3, C6, C9, C12		40	–	
DC Current Gain		h_{FE2}			
$V_{CE} = 1$ V, $I_C = 1$ A	C1, C4, C7, C10		10	–	
	C2, C5, C8, C11		20	–	
DC Current Gain		h_{FE3}			
$V_{CE} = 1$ V, $I_C = 2$ A	C3, C6, C9, C12		20	–	
Collector Saturation Voltage		$V_{CE(S)}$			V
$I_C = 1$ A, $I_B = 100$ mA				0.5	
Base Saturation Voltage		$V_{BE(S)}$			V
$I_C = 1$ A, $I_B = 100$ mA				1.3	
Gain Bandwidth Product		f_T			MHz
$V_{CE} = 4$ V, $I_C = 20$ mA			3		

POWER TRANSISTORS

NPN	PNP
NSP41	NSP42
NSP41A	NSP42A
NSP41B	NSP42B
NSP41C	NSP42C

NPN/PNP Complementary Silicon Power Transistors. These devices are designed and manufactured using National's "Epoxy B Concept." They feature exceptional reliability and are especially suitable for applications involving repeated on-off operation where wide operating temperature excursions are anticipated.

Complementary Silicon Power Transistors 50 Watts



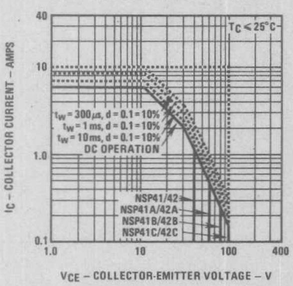
Package 37
TO-220

Maximum Ratings

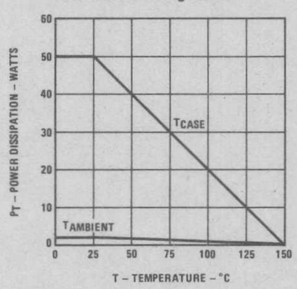
Parameter	Symbol	NSP41 NSP42	NSP41A NSP42A	NSP41B NSP42B	NSP41C NSP42C	Units
Collector-Base Voltage	V_{CB}	40	60	80	100	V
Collector-Emitter Voltage	V_{CEO}	40	60	80	100	V
Emitter-Base Voltage	V_{EB}	5				V
Collector Current (continuous)	I_C	5				A
(peak)		7				
Base Current	I_B	3				A
Power Dissipation ($T_C = 25°C$)	P_T	50				W
($T_A = 25°C$)		2				
Temperature Range	T_J, T_{STG}	-65 to +150				°C
Thermal Resistance	θ_{JC}	2.5				°C/W
	θ_{JA}	62.5				

Typical Performance Characteristics

Safe Operating Area Curve

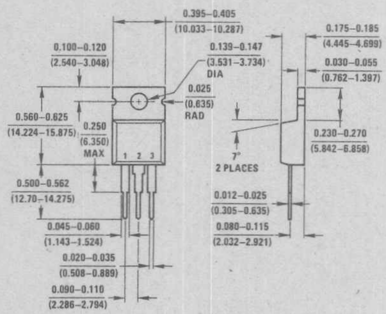


Thermal Derating Curve



Physical Dimensions

TO-220



NPN NSP41, NSP41A, NSP41B, NSP41C
PNP NSP42, NSP42A, NSP42B, NSP42C

Electrical Characteristics ($T_C = 25°C$ unless noted)

Parameter	Symbol	NSP41 NSP42 Min.	NSP41 NSP42 Max.	NSP41A NSP42A Min.	NSP41A NSP42A Max.	NSP41B NSP42B Min.	NSP41B NSP42B Max.	NSP41C NSP42C Min.	NSP41C NSP42C Max.	Units
Collector-Emitter Sustaining Voltage	V_{CEO}									
$I_C = 30$ mA, $I_B = 0$		40		60		80		100		V
Collector Cutoff Current	I_{CEO}									
$V_{CE} = 30$ V, $I_B = 0$			0.7		0.7		–		–	mA
$V_{CE} = 60$ V, $I_B = 0$			–		–		0.7		0.7	
Collector Cutoff Current	I_{CES}									
$V_{CE} = V_{CEO}$ Rated, $V_{BE} = 0$			0.4		0.4		0.4		0.4	mA
Emitter Cutoff Current	I_{EBO}									
$V_{EB} = 5$ V, $I_C = 0$			1		1		1		1	mA
DC Current Gain	h_{FE}									
$V_{CE} = 4$ V, $I_C = 0.3$ A		30		30		30		30		
$V_{CE} = 4$ V, $I_C = 3$ A		15	75	15	75	15	75	15	75	
Base-Emitter "ON" Voltage	$V_{BE(ON)}$									
$V_{CE} = 4$ V, $I_C = 5$ A			2		2		2		2	V
Collector-Emitter Saturation Voltage	$V_{CE(S)}$									
$I_C = 5$ A, $I_B = 0.5$ A			1.5		1.5		1.5		1.5	V
Small Signal Common Emitter Current Gain	h_{fe}									
$V_{CE} = 10$ V, $I_C = 0.5$ A, f = 1 kHz		20		20		20		20		
Gain Bandwidth Product	f_T									
$V_{CE} = 10$ V, $I_C = 0.5$ A, f = 1 MHz		3		3		3		3		MHz

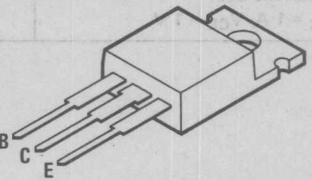
POWER TRANSISTORS

NPN
NSP520, NSP521
PNP
NSP370, NSP371

NPN/PNP Silicon Power Transistors designed for general purpose amplifier and switching circuits — recommended for use in Class B audio amplifier outputs rated from 5 to 20 watts.

The devices are designed and manufactured using National's "Epoxy B Concept" and offer exceptional reliability in any application which involves repeated temperature excursions due to self heating effects. The "power cycling" capability of "Epoxy B Concept" products is unexcelled.

Complemantary Silicon Audio Output Power Transistors 40 Watts



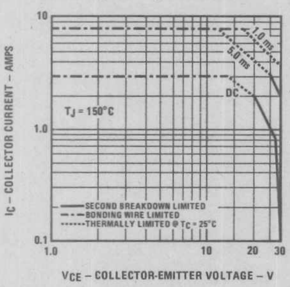
Package 37
TO-220

Maximum Ratings

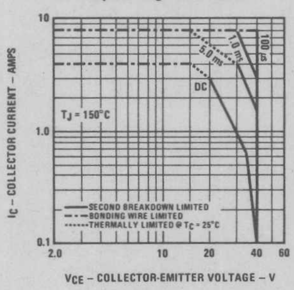
Parameter	Symbol	PNP NSP370	PNP NSP371	NPN NSP520	NPN NSP521	Units
Collector-Base Voltage	V_{CB}	30	40	30	40	V
Collector-Emitter Voltage	V_{CEO}	30	40	30	40	V
Emitter-Base Voltage	V_{EB}	4	4	4	4	V
Collector Current (continuous)	I_C	3	4	3	4	A
(peak)		7	8	7	8	
Base Current	I_B	2	2	2	2	A
Power Dissipation ($T_C = 25°C$)	P_T	40				W
($T_A = 25°C$)		2				
Temperature Range	T_J, T_{STG}	-65 to +150				°C
Thermal Resistance	θ_{JC}	3.125				°C/W
	θ_{JA}	62.5				

Typical Performance Characteristics

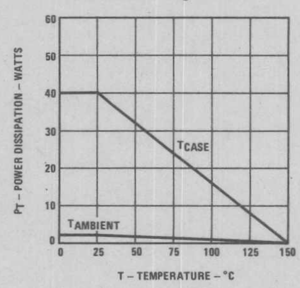
Safe Operating Area Curve



Safe Operating Area Curve



Thermal Derating Curve



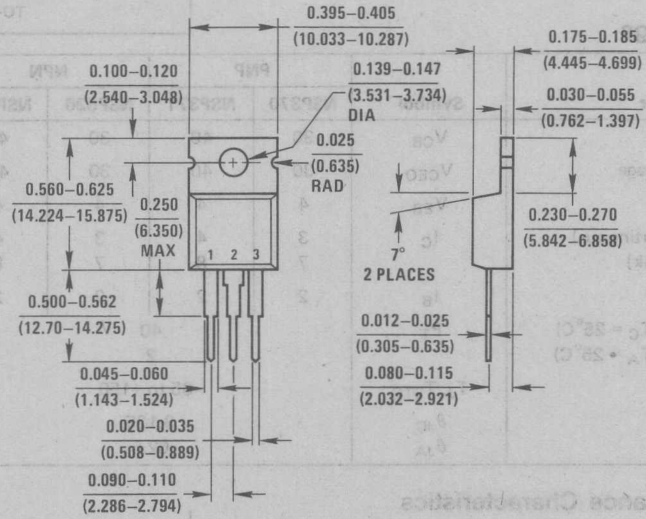
NPN NSP520, NSP521
PNP NSP370, NSP371

3

Parameter	Symbol					Units
Collector-Emitter Sustaining Voltage $I_C = 100\ mA$, $I_B = 0$	V_{CEO}	30		40		V
Collector-Base Cutoff Current $V_{CB} = V_{CB}$ Rated, $I_E = 0$	I_{CBO}		100		100	μA
Emitter-Base Cutoff Current $V_{EB} = 4.0\ V$, $I_C = 0$	I_{EBO}		100		100	μA
DC Current Gain $I_C = 1\ A$, $V_{CE} = 1\ V$	h_{FE}	25		40		

Physical Dimensions

TO-220



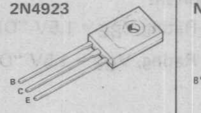
POWER TRANSISTORS

NPN
2N4921 thru 2N4923
NSP4921 thru NSP4923
PNP
2N4918 thru 2N4920
NSP4918 thru NSP4920

Complementary Silicon Power Transistors

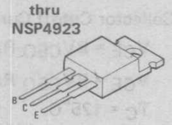
30 Watts **40 Watts**

2N4918 thru 2N4923



Package 38
TO-126

NSP4918 thru NSP4923



Package 27
TO-220

NPN/PNP Complementary Silicon Power Transistors employing Epitaxial Base Mesa Technology. This series is designed for driver circuits, switching and amplifier applications.

This family features National's TO-126 and TO-220 packages which are designed and manufactured using National's "Epoxy B Concept". The "Epoxy B Concept" offers exceptional reliability in applications involving repeated "ON"/"OFF" operation where wide temperature excursions are anticipated.

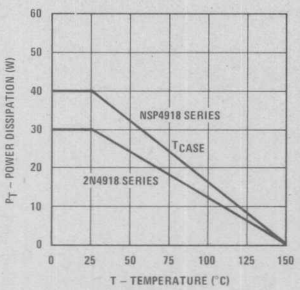
The NSP4918 through NSP4923 series is a direct replacement for the MJE4918 thru MJE4923 series.

Maximum Ratings

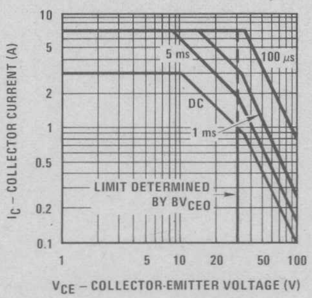
PARAMETER	SYMBOL	2N4918 2N4921 NSP4918 NSP4921	2N4919 2N4922 NSP4919 NSP4922	2N4920 2N4923 NSP4920 NSP4923	UNITS
Collector-Base Voltage	V_{CB}	40	60	80	V
Collector-Emitter Voltage	V_{CEO}	40	60	80	V
Emitter-Base Voltage	V_{EB}	5	5	5	V
Collector Current (Continuous)	I_C	1.0	1.0	1.0	A
(Peak)		3.0	3.0	3.0	A
Base Current	I_B	1.0	1.0	1.0	A
		2N4918 SERIES		NSP4918 SERIES	
Power Dissipation ($T_C = 25°C$)	P_T	30		40	W
($T_A = 25°C$)		1.5		2.0	W
Temperature Range	T_J, T_{STG}	−65 to +150		−65 to +150	°C
Thermal Resistance	θ_{JC}	4.16		3.125	°C/W
	θ_{JA}	83.3		62.5	°C/W

Typical Performance Characteristics

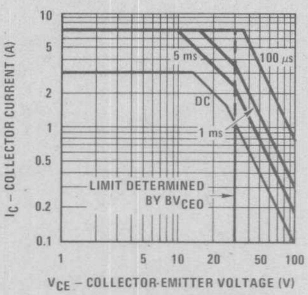
Thermal Derating Curve



Safe Operating Area 2N4918-23



Safe Operating Area NSP4918-23



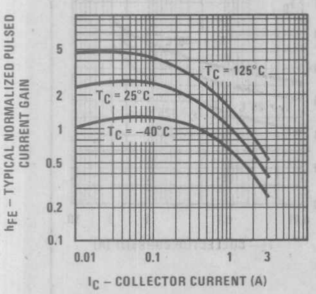
Electrical Characteristics ($T_C = 25°C$ unless noted)

PARAMETER	SYMBOL	2N4918 2N4921 NSP4918 NSP4921		2N4919 2N4922 NSP4918 NSP4922		2N4920 2N4923 NSP4920 NSP4923		UNITS
		MIN	MAX	MIN	MAX	MIN	MAX	
Collector-Emitter Sustaining Voltage $I_C = 100$ mA, $I_B = 0$	BV_{CEO}	40		60		80		V
Collector Cutoff Current $V_{CE} = 1/2\ BV_{CEO}$ Rating, $I_B = 0$	I_{CEO}		0.5		0.5		0.5	mA
Collector Cutoff Current $V_{CE} = BV_{CEO}$ Rating, $V_{BE} = 1.5V$ "OFF",	I_{CEX}		0.1		0.1		0.1	mA
$V_{CE} = BV_{CEO}$ Rating, $V_{BE} = 1.5V$ "OFF", $T_C = 125°C$			0.5		0.5		0.5	
Collector Cutoff Current $V_{CB} = V_{CB}$ Rating, $I_E = 0$	I_{CBO}		0.1		0.1		0.1	mA
Emitter Cutoff Current $V_{EB} = 5V$, $I_C = 0$	I_{EBO}		1.0		1.0		1.0	mA
DC Current Gain	h_{FE}							
$I_C = 50$ mA, $V_{CE} = 1V$		40		40		40		
$I_C = 500$ mA, $V_{CE} = 1V$		20	100	20	100	20	100	
$I_C = 1A$, $V_{CE} = 1V$		10		10		10		
Collector-Emitter Saturation Voltage $I_C = 1A$, $I_B = 100$ mA	$V_{CE(S)}$		0.6		0.6		0.6	V
Base-Emitter Saturation Voltage $I_C = 1A$, $I_B = 100$ mA	$V_{BE(S)}$		1.3		1.3		1.3	V
Base-Emitter "ON" Voltage $I_C = 1A$, $V_{CE} = 1A$	$V_{BE(ON)}$		1.3		1.3		1.3	V
Gain Bandwidth Product $I_C = 250$ mA, $V_{CE} = 10V$, f = 1 MHz	f_T	3		3		3		MHz

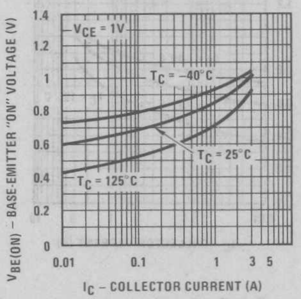
Typical Performance Characteristics (Continued)

2N4918 thru 2N4920 and NSP4918 thru NSP4920

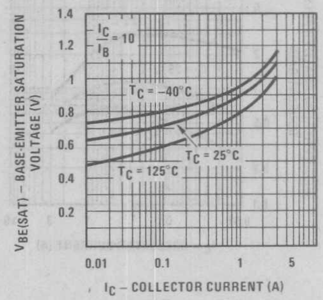
Typical Normalized Pulsed Current Gain vs Collector Current



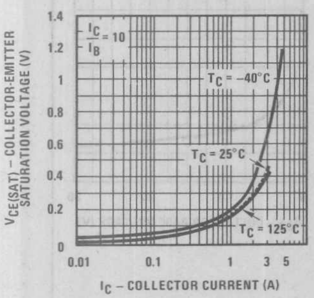
Base-Emitter "ON" Voltage vs Collector Current



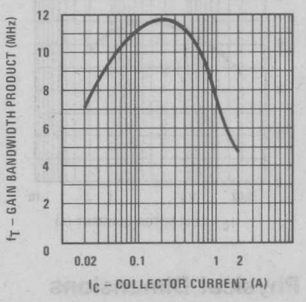
Base-Emitter Saturation Voltage vs Collector Current



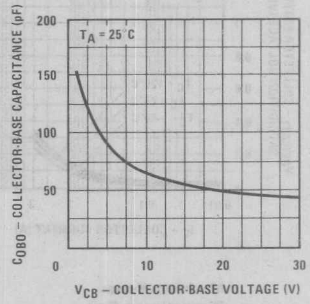
Collector-Emitter Saturation Voltage vs Collector Current



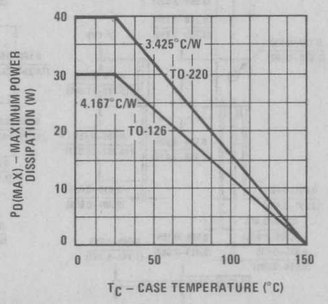
Gain Bandwidth Product vs Collector Current



Typical Collector Capacitance vs Collector-Base Voltage



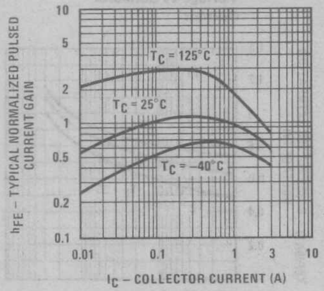
Maximum Power Dissipation vs Case Temperature



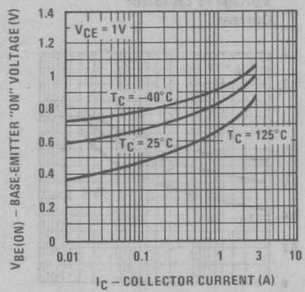
Typical Performance Characteristics (Continued)

2N4921 thru 2N4923 and NSP4921 thru NSP4923

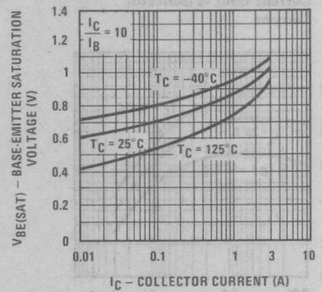
Typical Normalized Pulsed Current Gain vs Collector Current



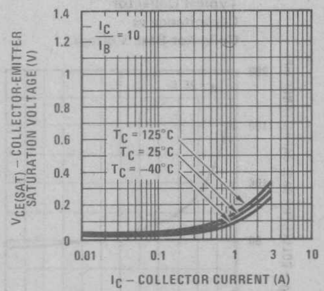
Base-Emitter "ON" Voltage vs Collector Current



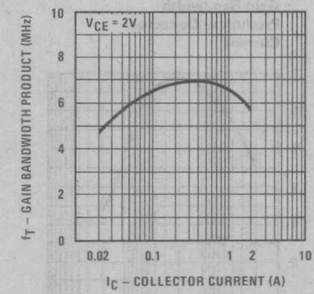
Base-Emitter Saturation Voltage vs Collector Current



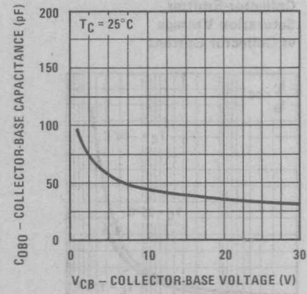
Collector-Emitter Saturation Voltage vs Collector Current



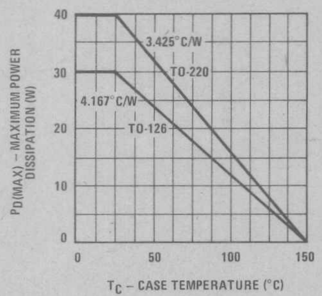
Gain Bandwidth Product vs Collector Current



Collector-Base Capacitance vs Collector-Base Voltage

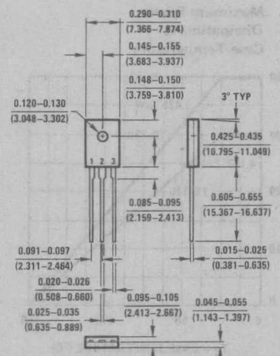


Maximum Power Dissipation vs Case Temperature



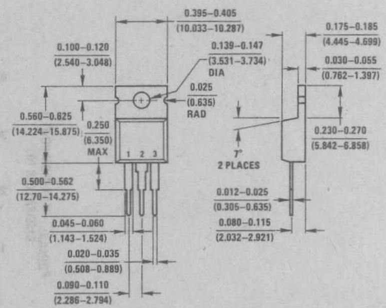
Physical Dimensions

TO-126



Pin 1. Emitter
2. Collector
3. Base

TO-220



Pin 1. Base
2. Collector
3. Emitter

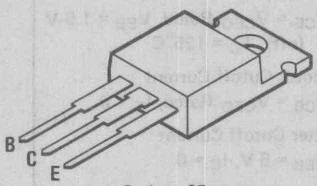
POWER TRANSISTORS

NSP5190 thru NSP5195

NPN/PNP Complementary Silicon Power Transistors employing Epitaxial Base Mesa Technology. This series is a direct electrical replacement for the 2N5190-95 family of devices.

The NSP5190-95 family features National's TO-220 package which is designed and manufactured using National's "Epoxy B Concept." The Epoxy B Concept offers exceptional reliability in applications involving repeated on-off operation where wide temperature excursions are anticipated.

Complementary Silicon Power Transistors 60 Watts/4 Amps



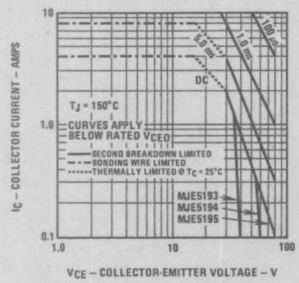
Package 37
TO-220

Maximum Ratings

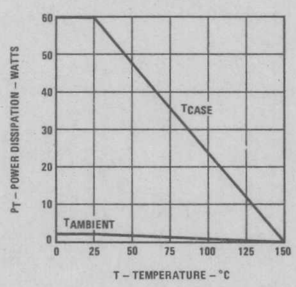
Parameter	Symbol	NSP5190 NSP5193	NSP5191 NSP5194	NSP5192 NSP5195	Units
Collector-Base Voltage	V_{CB}	40	60	80	V
Collector-Emitter Voltage	V_{CEO}	40	60	80	V
Emitter-Base Voltage	V_{EB}		5		V
Collector Current	I_C		4		A
Base Current	I_B		1		A
Power Dissipation ($T_C = 25°C$)	P_T		60		W
($T_A = 25°C$)			2		
Temperature Range	T_J, T_{STG}		-65 to +150		°C
Thermal Resistance	θ_{JC}		2.08		°C/W
	θ_{JA}		62.5		

Typical Performance Characteristics

Safe Operating Area Curve

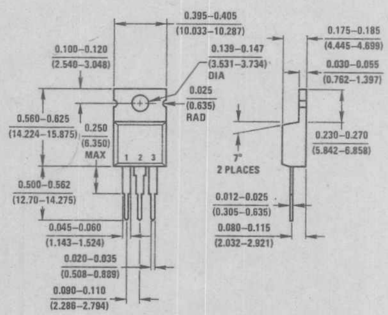


Thermal Derating Curve



Physical Dimensions

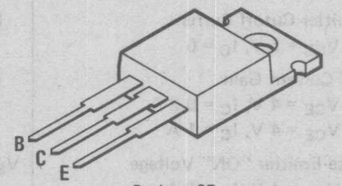
TO-220



$I_C = 100$ mA, $I_B = 0$		40		60		80		V
Collector Cutoff Current	I_{CEO}							
$V_{CE} = V_{CEO}$ Rated, $I_B = 0$			1.0		1.0		1.0	mA
Collector Cutoff Current	I_{CEX}							
$V_{CE} = V_{CEO}$ Rated, $V_{EB} = 1.5$ V (off)			0.1		0.1		0.1	mA
$V_{CE} = V_{CEO}$ Rated, $V_{EB} = 1.5$ V (off), $T_C = 125^\circ$C			2.0		2.0		2.0	
Collector Cutoff Current	I_{CBO}							
$V_{CB} = V_{CEO}$ Rated, $I_E = 0$			0.1		0.1		0.1	mA
Emitter Cutoff Current	I_{EBO}							
$V_{EB} = 5$ V, $I_C = 0$			1.0		1.0		1.0	mA
DC Current Gain	h_{FE}							
$I_C = 1.5$ A, $V_{CE} = 2.0$ V		25	100	25	100	20	80	
$I_C = 4$ A, $V_{CE} = 2$ V		10		10		7		
Collector-Emitter Saturation Voltage	$V_{CE(S)}$							
$I_C = 1.5$ A, $I_B = 150$ mA			0.6		0.6		0.6	V
$I_C = 4$ A, $I_B = 1.0$ A			1.4		1.4		1.4	
Base-Emitter "ON" Voltage	$V_{BE(ON)}$							
$I_C = 1.5$ A, $V_{CE} = 2$ V			1.2		1.2		1.2	V
Gain-Bandwidth Product	f_T							
$I_C = 1$ A, $V_{CE} = 10$ V, $f = 1$ MHz		2		2		2		MHz

NPN/PNP Complementary Silicon Power Transistors. These devices are designed and manufactured using National's "Epoxy B Concept." They feature exceptional reliability and are especially suitable for applications involving repeated on-off operation where wide operating temperature excursions are anticipated.

Complementary Silicon Power Transistors 30 Watts



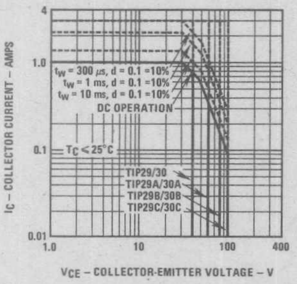
Package 37
TO-220

Maximum Ratings

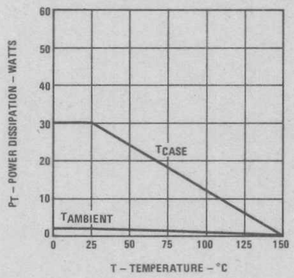
Parameter	Symbol	TIP29 TIP30	TIP29A TIP30A	TIP29B TIP30B	TIP29C TIP30C	Units
Collector-Base Voltage	V_{CB}	40	60	80	100	V
Collector-Emitter Voltage	V_{CEO}	40	60	80	100	V
Emitter-Base Voltage	V_{EB}	5				V
Collector Current (continuous)	I_C	1				A
(peak)		3				
Base Current (continuous)	I_B	0.5				A
Power Dissipation ($T_C = 25°C$)	P_T	30				W
($T_A = 25°C$)		2				
Temperature Range	T_J, T_{STG}	-65 to +150				°C
Thermal Resistance	θ_{JC}	4.16				°C/W
	θ_{JA}	62.5				

Typical Performance Characteristics

Safe Operating Area Curve

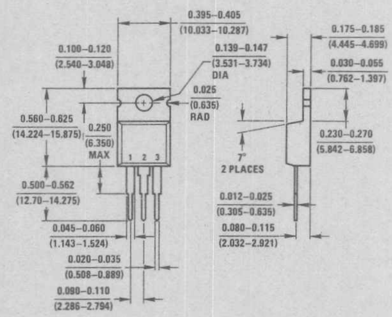


Thermal Derating Curve



Physical Dimensions

TO-220



Electrical Characteristics ($T_C = 25°C$ unless noted)

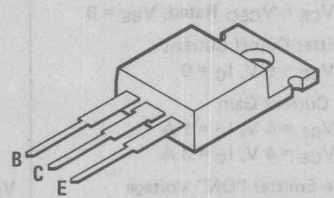
Parameter	Symbol	TIP29 TIP30 Min.	TIP29 TIP30 Max.	TIP29A TIP30A Min.	TIP29A TIP30A Max.	TIP29B TIP30B Min.	TIP29B TIP30B Max.	TIP29C TIP30C Min.	TIP29C TIP30C Max.	Units
Collector-Emitter Sustaining Voltage	V_{CEO}									
$I_C = 30$ mA, $I_B = 0$		40		60		80		100		V
Collector Cutoff Current	I_{CEO}									
$V_{CE} = 30$ V, $I_B = 0$			0.3		0.3		–		–	mA
$V_{CE} = 60$ V, $I_B = 0$			–		–		0.3		0.3	
Collector Cutoff Current	I_{CES}									
$V_{CE} = V_{CEO}$ Rated, $V_{BE} = 0$			0.2		0.2		0.2		0.2	mA
Emitter Cutoff Current	I_{EBO}									
$V_{EB} = 5$ V, $I_C = 0$			1		1		1		1	mA
DC Current Gain	h_{FE}									
$V_{CE} = 4$ V, $I_C = 0.2$ A		40		40		40		40		
$V_{CE} = 4$ V, $I_C = 1$ A		15	75	15	75	15	75	15	75	
Base-Emitter "ON" Voltage	$V_{BE(ON)}$									
$V_{CE} = 4$ V, $I_C = 1$ A			1.3		1.3		1.3		1.3	V
Collector-Emitter Saturation Voltage	$V_{CE(S)}$									
$I_C = 1$ A, $I_B = 125$ mA			0.7		0.7		0.7		0.7	V
Small Signal Common Emitter Current Gain	h_{fe}									
$V_{CE} = 10$ V, $I_C = 0.2$ A, f = 1 kHz		20		20		20		20		
Gain Bandwidth Product	f_T									
$V_{CE} = 10$ V, $I_C = 0.2$ A, f = 1 MHz		3		3		3		3		MHz

POWER TRANSISTORS

NPN	PNP
TIP31	TIP32
TIP31A	TIP32A
TIP31B	TIP32B
TIP31C	TIP32C

NPN/PNP Complementary Silicon Power Transistors. These devices are designed and manufactured using National's "Epoxy B Concept." They feature exceptional reliability and are especially suitable for applications involving repeated on-off operation where wide operating temperature excursions are anticipated.

Complementary Silicon Power Transistors 40 Watts



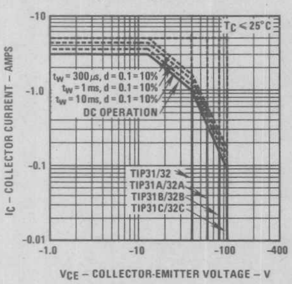
Package 37
TO-220

Maximum Ratings

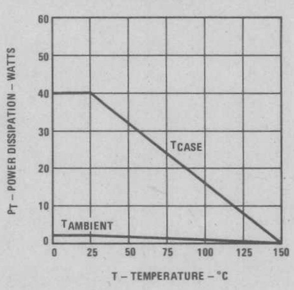
Parameter	Symbol	TIP31 TIP32	TIP31A TIP32A	TIP31B TIP32B	TIP31C TIP32C	Units
Collector-Base Voltage	V_{CB}	40	60	80	100	V
Collector-Emitter Voltage	V_{CEO}	40	60	80	100	V
Emitter-Base Voltage	V_{EB}		5			V
Collector Current (continuous)	I_C		3			A
(peak)			5			
Base Current	I_B		1			A
Power Dissipation ($T_C = 25°C$)	P_T		40			W
($T_A = 25°C$)			2			
Temperature Range	T_J, T_{STG}		-65 to +150			°C
Thermal Resistance	θ_{JC}		3.125			°C/W
	θ_{JA}		62.5			

Typical Performance Characteristics

Safe Operating Area Curve

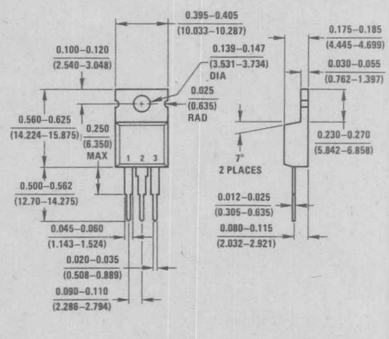


Thermal Derating Curve



Physical Dimensions

TO-220

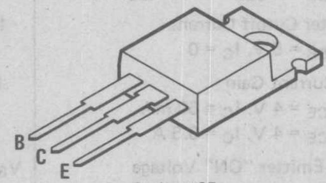


Electrical Characteristics ($T_C = 25°C$ unless noted)

Parameter	Symbol	TIP31 TIP32 Min.	TIP31 TIP32 Max.	TIP31A TIP32A Min.	TIP31A TIP32A Max.	TIP31B TIP32B Min.	TIP31B TIP32B Max.	TIP31C TIP32C Min.	TIP31C TIP32C Max.	Units
Collector-Emitter Sustaining Voltage	V_{CEO}									
$I_C = 30$ mA, $I_B = 0$		40		60		80		100		V
Collector Cutoff Current	I_{CEO}									
$V_{CE} = 30$ V, $I_B = 0$			0.3		0.3					mA
$V_{CE} = 60$ V, $I_B = 0$							0.3		0.3	
Collector Cutoff Current	I_{CES}									
$V_{CE} = V_{CEO}$ Rated, $V_{BE} = 0$			0.2		0.2		0.2		0.2	mA
Emitter Cutoff Current	I_{EBO}									
$V_{EB} = 5$ V, $I_C = 0$			1		1		1		1	mA
DC Current Gain	h_{FE}									
$V_{CE} = 4$ V, $I_C = 1$ A		25		25		25		25		
$V_{CE} = 4$ V, $I_C = 3$ A		10	50	10	50	10	50	10	50	
Base-Emitter "ON" Voltage	$V_{BE(ON)}$									
$V_{CE} = 4$ V, $I_C = 3$ A			1.8		1.8		1.8		1.8	V
Collector-Emitter Saturation Voltage	$V_{CE(S)}$									
$I_C = 3$ A, $I_B = 375$ mA			1.2		1.2		1.2		1.2	V
Small Signal Common Emitter Current Gain	h_{fe}									
$V_{CE} = 10$ V, $I_C = 0.5$ A, f = 1 kHz		20		20		20		20		
Gain Bandwidth Product	f_T									
$V_{CE} = 10$ V, $I_C = 0.5$ A, f = 1 MHz		3		3		3		3		MHz

NPN/PNP Complementary Silicon Power Transistors. These devices are designed and manufactured using National's "Epoxy B Concept." They feature exceptional reliability and are especially suitable for applications involving repeated on-off operation where wide operating temperature excursions are anticipated.

Complementary Silicon Power Transistors 20 Watts



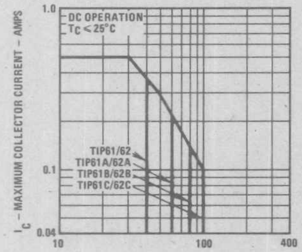
Package 37
TO-220

Maximum Ratings

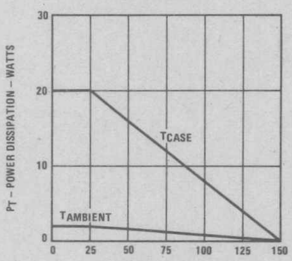
Parameter	Symbol	TIP61 TIP62	TIP61A TIP62A	TIP61B TIP62B	TIP61C TIP62C	Units
Collector-Base Voltage	V_{CB}	40	60	80	100	V
Collector-Emitter Voltage	V_{CEO}	40	60	80	100	V
Emitter-Base Voltage	V_{EB}	5				V
Collector Current (continuous)	I_C	0.5				A
(peak)		1.5				
Base Current	I_B	0.4				A
Power Dissipation (T_C = 25°C)	P_T	20				W
(T_A = 25°C)		1.5				
Temperature Range	T_J, T_{STG}	-65 to +150				°C
Thermal Resistance	θ_{JC}	6.25				°C/W
	θ_{JA}	83.3				

Typical Performance Characteristics

Safe Operating Area Curve

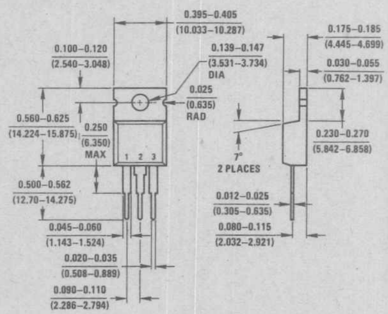


Thermal Derating Curve



Physical Dimensions

TO-220



Electrical Characteristics (T_C = 25°C unless noted)

Parameter	Symbol	TIP61 TIP62 Min.	TIP61 TIP62 Max.	TIP61A TIP62A Min.	TIP61A TIP62A Max.	TIP61B TIP62B Min.	TIP61B TIP62B Max.	TIP61C TIP62C Min.	TIP61C TIP62C Max.	Units
Collector-Emitter Sustaining Voltage I_C = 30 mA, I_B = 0	V_{CEO}	40		60		80		100		V
Collector Cutoff Current	I_{CEO}									
V_{CE} = 30 V, I_B = 0			0.3		0.3		–		–	mA
V_{CE} = 60 V, I_B = 0			–		–		0.3		0.3	
Collector Cutoff Current V_{CE} = V_{CEO} Rated, V_{BE} = 0	I_{CES}		0.2		0.2		0.2		0.2	mA
Emitter Cutoff Current V_{EB} = 5 V, I_C = 0	I_{EBO}		1		1		1		1	mA
DC Current Gain	h_{FE}									
V_{CE} = 4 V, I_C = 50 mA		40		40		40		40		
V_{CE} = 4 V, I_C = 0.5 A		15	100	15	100	15	100	15	100	
Base-Emitter "ON" Voltage V_{CE} = 4 V, I_C = 0.5 A	$V_{BE(ON)}$		1.3		1.3		1.3		1.3	V
Collector-Emitter Saturation Voltage I_C = 0.5 A, I_B = 60 mA	$V_{CE(S)}$		0.7		0.7		0.7		0.7	V
Small Signal Common Emitter Current Gain V_{CE} = 10 V, I_C = 50 mA, f = 1 kHz	h_{fe}	20		20		20		20		
Gain Bandwidth Product V_{CE} = 10 V, I_C = 50 mA, f = 1 MHz	f_T	3		3		3		3		MHz

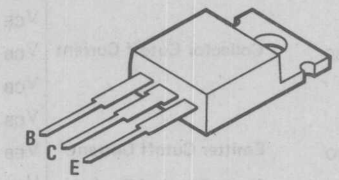
POWER TRANSISTORS

NPN **TIP110** **TIP111** **TIP112**

PNP **TIP115** **TIP116** **TIP117**

NPN/PNP Complementary Silicon Power Darlington Transistors. These devices are designed and manufactured using National's "Epoxy B Concept." They feature exceptional reliability and are especially suitable for applications involving repeated on-off operation where wide operating temperature excursions are anticipated.

Complementary Silicon Power Transistors 50 Watts



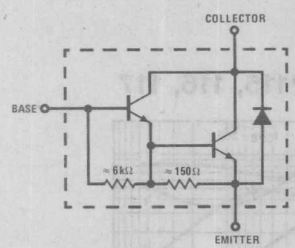
Package 37
TO-220

Maximum Ratings

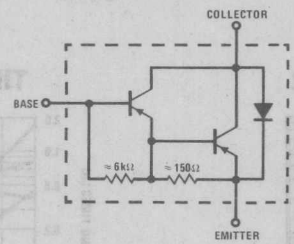
Parameter	Symbol	TIP110 TIP115	TIP111 TIP116	TIP112 TIP117	Units
Collector-Base Voltage	V_{CB}	60	80	100	V
Collector-Emitter Voltage	V_{CEO}	60	80	100	V
Emitter-Base Voltage	V_{EB}	5	5	5	V
Collector Current (continuous)	I_C	2	2	2	A
(peak)		4	4	4	A
Base Current (continuous)	I_B	50	50	50	mA
Power Dissipation (T_C = 25°C)	P_T	50	50	50	W
(T_A = 25°C)		2	2	2	W
Temperature Range	T_J, T_{STG}	−65 to +150	−65 to +150	−65 to +150	°C
Thermal Resistance	θ_{JC}	2.5	2.5	2.5	°C/W
	θ_{JA}	62.5	62.5	62.5	°C/W

Connection Diagrams

NPN

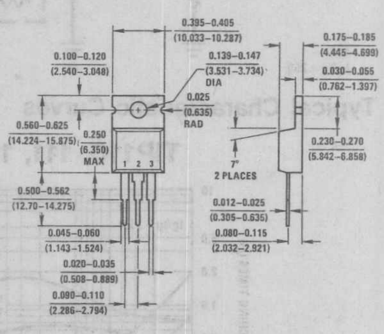


PNP



Physical Dimensions

TO-220



Pin 1 – Base
2 – Collector
3 – Emitter

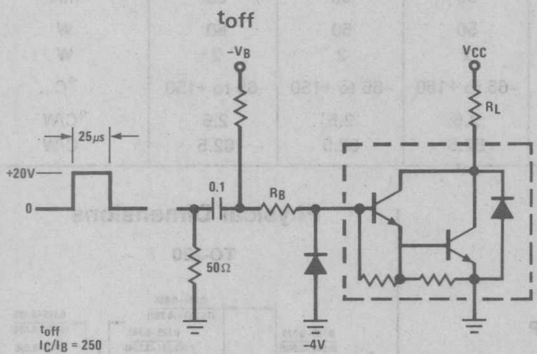
Collector is in electrical conduct with the mounting tab.

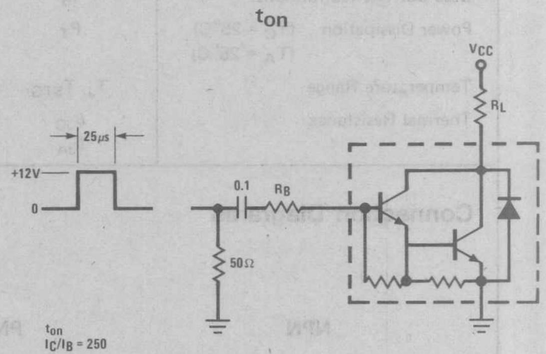
Electrical Characteristics ($T_C = 25°C$ unless otherwise noted.)

Symbol	Parameter	Test Conditions	TIP110 TIP115 Min	TIP110 TIP115 Max	TIP111 TIP116 Min	TIP111 TIP116 Max	TIP112 TIP117 Min	TIP112 TIP117 Max	Units
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	$I_C = 30mA$, $I_B = 0$ See Note 1	60		80		100		V
I_{CEO}	Collector Cutoff Current	$V_{CE} = 30V$, $I_B = 0$		2					mA
		$V_{CE} = 40V$, $I_B = 0$				2			
		$V_{CE} = 50V$, $I_B = 0$						2	
I_{CBO}	Collector Cutoff Current	$V_{CB} = 60V$, $I_E = 0$		1					mA
		$V_{CB} = 80V$, $I_E = 0$				1			
		$V_{CB} = 100V$, $I_E = 0$						1	
I_{EBO}	Emitter Cutoff Current	$V_{EB} = 5V$, $I_C = 0$		2		2		2	mA
h_{FE}	Static Forward Current Transfer Ratio	$V_{CE} = 4V$, $I_C = 1A$ See Notes 1 and 2	1000		1000		1000		
		$V_{CE} = 4V$, $I_C = 2A$	500		500		500		
V_{BE}	Base-Emitter Voltage	$V_{CE} = 4V$, $I_C = 2A$ See Notes 1 and 2		2.8		2.8		2.8	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$I_B = 8mA$, $I_C = 2A$ See Notes 1 and 2		2.5		2.5		2.5	V
V_F	Parallel Diode Forward Voltage Drop	$I_C = -4A$, $I_B = 0$		5.0		5.0		5.0	V

NOTES: 1. These parameters must be measured using pulse techniques, $t_W = 300\mu s$, duty cycle $\leq 2\%$.
2. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts and located within an inch from the device body.

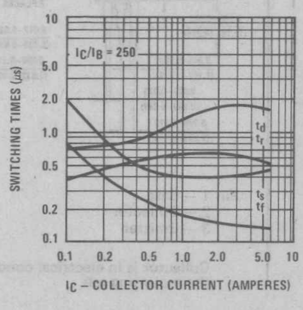
Switching Time Test Circuits



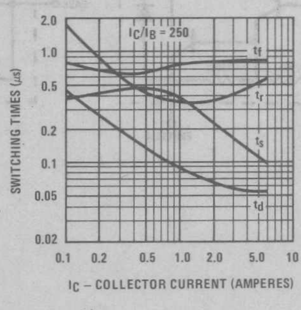


Typical Characteristic Curves

TIP110, 111, 112

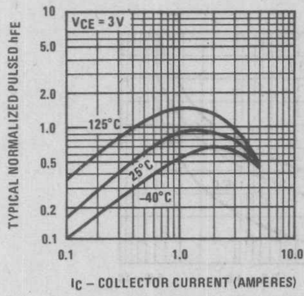


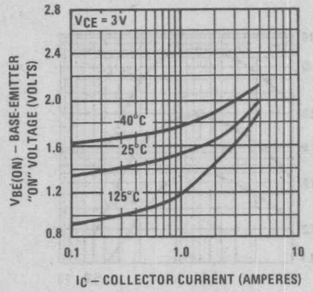
TIP115, 116, 117

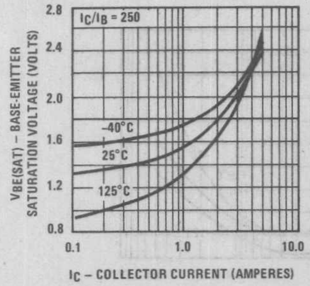


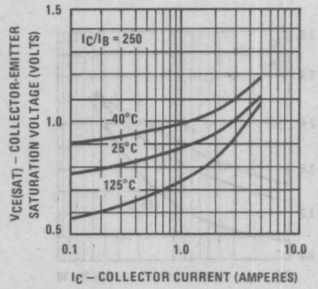
Typical Characteristic Curves ($T_C = 25^\circ C$ unless otherwise noted.)

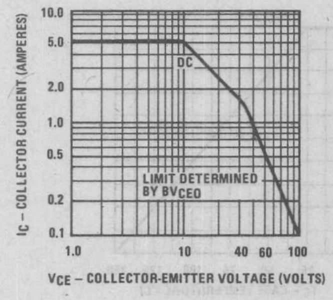
TIP110, 111, 112

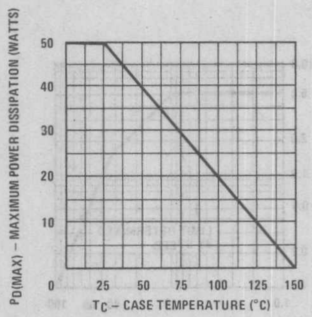








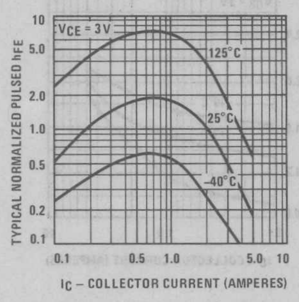


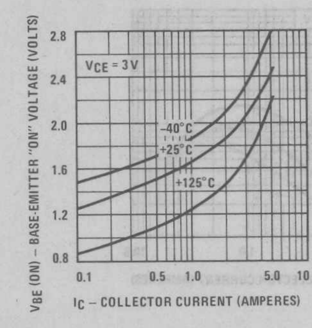


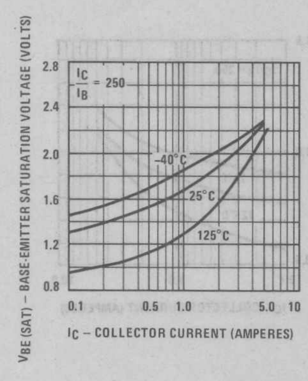
3

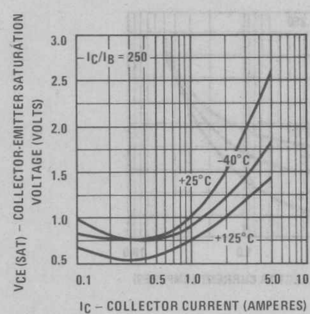
Typical Characteristic Curves (Continued)

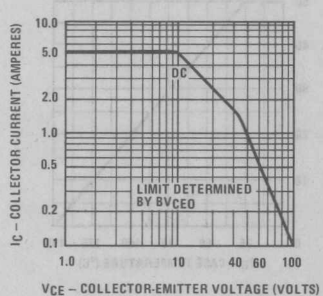
TIP115, 116, 117

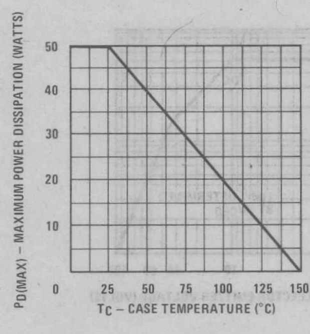












POWER TRANSISTORS

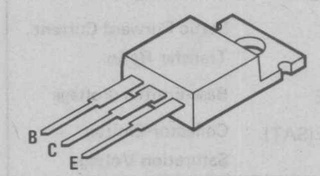
NPN TIP120
PNP TIP125

NPN/PNP Complementary Silicon Power Darlington Transistors. These devices are designed and manufactured using National's "Epoxy B Concept." They feature exceptional reliability and are especially suitable for applications involving repeated "ON"/"OFF" operation where wide operating temperature excursions are anticipated.

Designed for complementary use.

- 65W at 25°C case temperature
- 5A rated collector current
- Min h_{FE} of 1000 at 3V, 3A
- 50 mJ reverse energy rating

Complementary Silicon Power Transistors 65 Watts



Package 37
TO-220

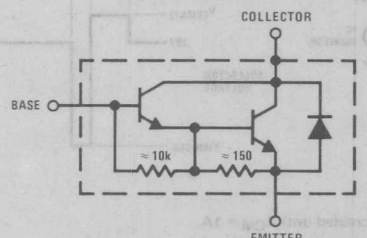
Maximum Ratings

PARAMETER	SYMBOL	TIP120	TIP125	UNITS
Collector-Base Voltage	V_{CB}	60	−60	V
Collector-Emitter Voltage	V_{CEO}	60	−60	V
Emitter-Base Voltage	V_{EB}	5	−5	V
Collector Current (Continuous)	I_C	5	−5	A
(Peak), (Note 1)		8	−8	A
Base Current (Continuous)	I_B	0.1	−0.1	A
Safe Operating Areas at (or below) 25°C Case Temperature		(See Maximum Safe Operating Curves)		
Device Dissipation ($T_C \leq 25°C$)	P_T	65	65	W
($T_A \leq 25°C$)		2	2	W
Temperature Range	T_J, T_{STG}	−65 to +150	−65 to +150	°C
Lead Temperature, (Soldering, 10 seconds)		260	260	°C

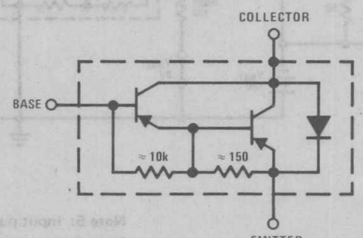
Note 1: This value applies for $t_W \leq 0.3$ ms, duty cycle $\leq 10\%$.

Connection Diagrams

NPN TIP120



PNP TIP125



NPN TIP120, PNP TIP125

3

Electrical Characteristics (T_C = 25°C unless otherwise noted.)

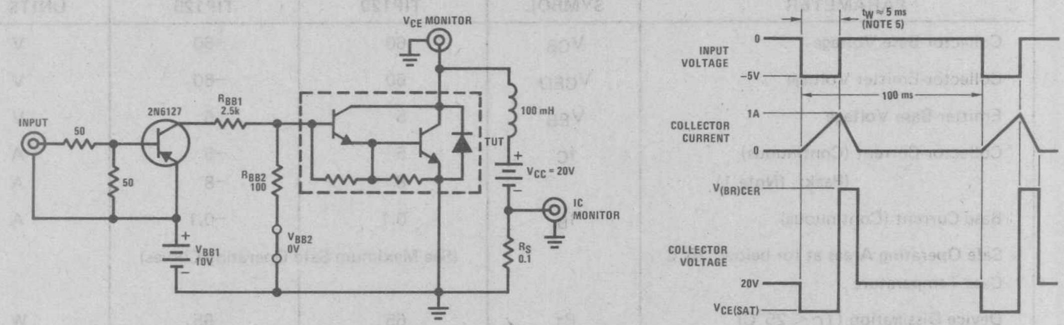
PARAMETER		CONDITIONS (Note 3)	TIP120		TIP125		UNITS
			MIN	MAX	MIN	MAX	
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	I_C = 30 mA, I_B = 0, (Note 2)	60		−60		V
I_{CEO}	Collector Cutoff Current	V_{CE} = 30V, I_B = 0		0.5		−0.5	mA
I_{CBO}	Collector Cutoff Current	V_{CB} = 60V, I_E = 0		0.2		−0.2	mA
I_{EBO}	Emitter Cutoff Current	V_{EB} = 5V, I_C = 0		2		−2	mA
h_{FE}	Static Forward Current Transfer Ratio	V_{CE} = 3V, I_C = 0.5A, (Notes 1 and 3)	1000		1000		
		V_{CE} = 3V, I_C = 3A, (Notes 1 and 3)	1000		1000		
V_{BE}	Base-Emitter Voltage	V_{CE} = 3V, I_C = 3A, (Notes 1 and 3)		2.5		−2.5	V
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	I_B = 12 mA, I_C = 3A, (Notes 1 and 3)		2		−2	V
		I_B = 20 mA, I_C = 5A, (Notes 1 and 3)		4		−4	V

Note 2: These parameters must be measured using pulse techniques, t_W = 300 μs, duty cycle ≤ 2%.

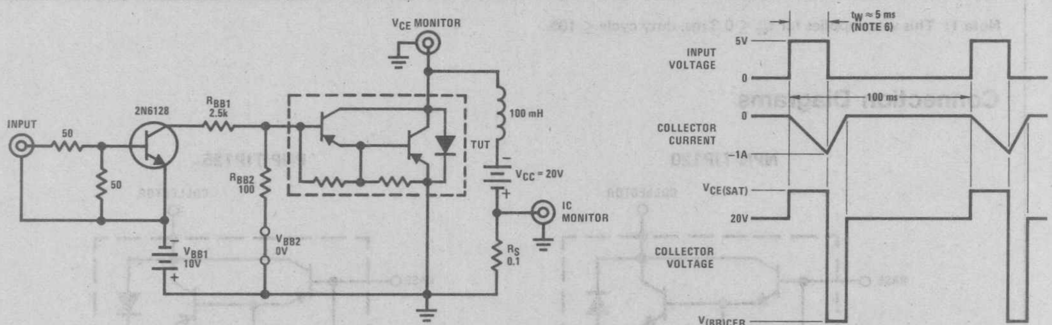
Note 3: These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts and located within 0.125 inch from the device body.

Note 4: All conditions for TIP125 are a negative value.

NPN TIP120

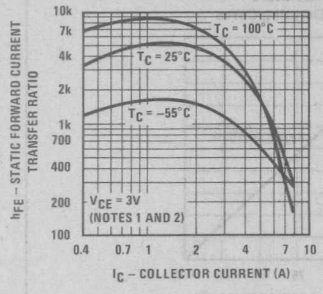


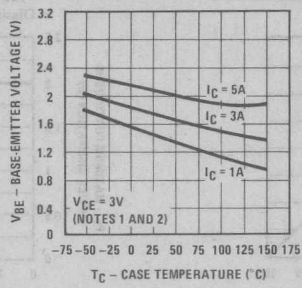
PNP TIP125

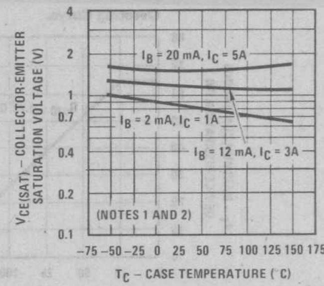


Note 5: Input pulse width is increased until I_{CM} = 1A.
Note 6: Input pulse width is increased until I_{CM} = −1A.

FIGURE 1

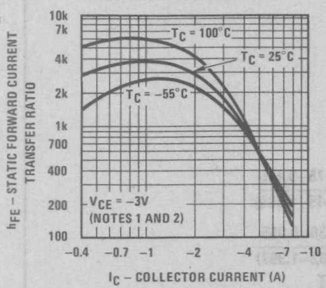




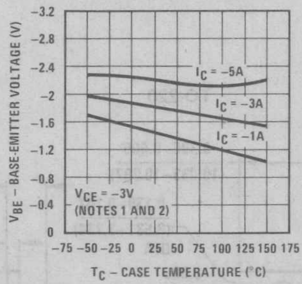


PNP TIP125

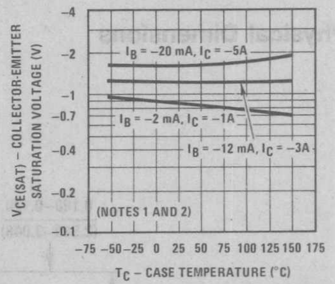
Static Forward Current Transfer Ratio vs Collector Current



Base-Emitter Voltage vs Case Temperature



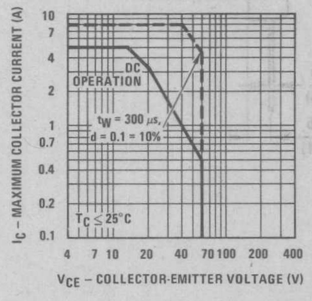
Collector-Emitter Saturation Voltage vs Case Temperature



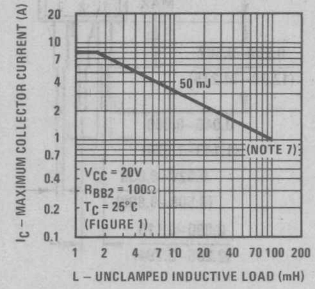
Maximum Safe Operating Curves

NPN TIP120

Maximum Collector Current vs Collector-Emitter Voltage

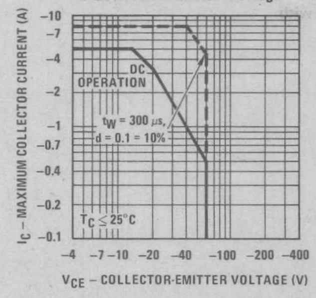


Maximum Collector Current vs Unclamped Inductive Load

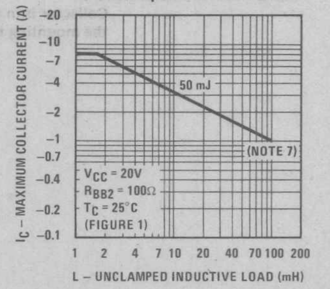


PNP TIP125

Maximum Collector Current vs Collector-Emitter Voltage



Maximum Collector Current vs Unclamped Inductive Load

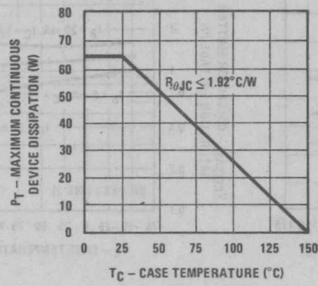


Note 7: Above this point, the Safe Operating Area has not been defined.

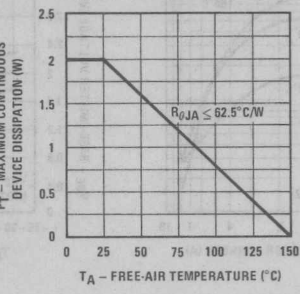
Thermal Information Curves

NPN TIP120, PNP TIP125

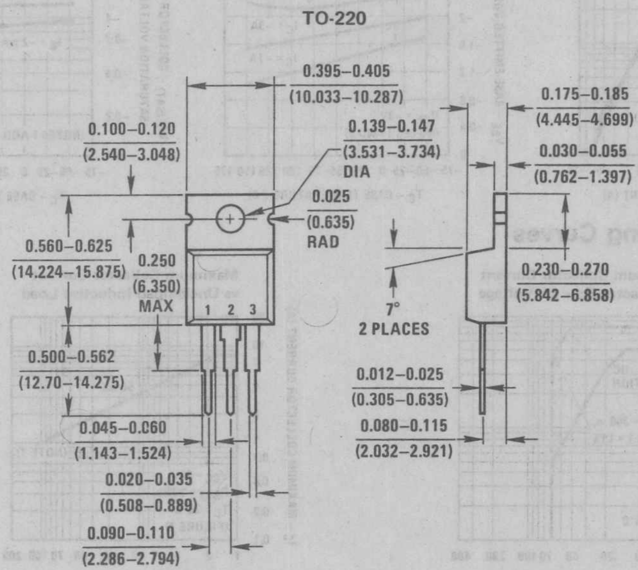
Case Temperature Dissipation Derating Curve



Free-Air Temperature Dissipation Derating Curve



Physical Dimensions



Pin 1 — Base
2 — Collector
3 — Emitter

Collector is in electrical conduct with the mounting tab.

POWER TRANSISTORS

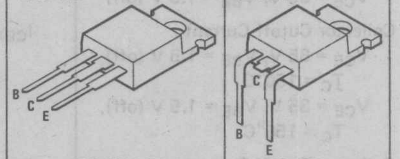
2N5293 thru 2N5298

NPN General Purpose Silicon Power Transistors designed for medium power switching and amplifier applications in Military, Commercial and Industrial equipment.

These devices are designed and manufactured using National's "Epoxy B Concept." They are especially useful in applications involving repeated on-off operation where wide temperature excursions are anticipated. The transistor family is offered with straight leads or pre-formed for insertion in TO-66 sockets.

NPN Silicon Power Transistors 36 Watts/4 Amps

2N5294 2N5296 2N5298	2N5293 2N5295 2N5297



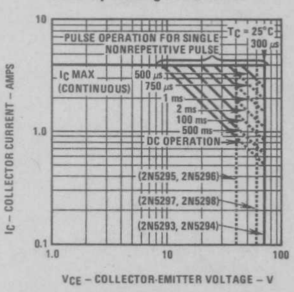
TO-220AB TO-220AA

Maximum Ratings

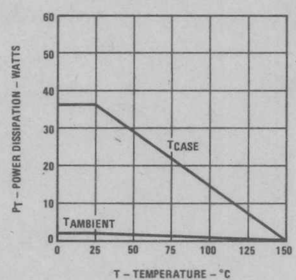
Parameter	Symbol	2N5293 2N5294	2N5295 2N5296	2N5297 2N5298	Units
Collector-Base Voltage	V_{CB}	80	60	80	V
Collector-Emitter Voltage	V_{CEO}	70	40	60	V
Emitter-Base Voltage	V_{EB}	7	5	5	V
Collector Current	I_C		4		A
Base Current	I_B		2		A
Power Dissipation ($T_C = 25°C$)	P_T		36		W
($T_A = 25°C$)			1.8		
Temperature Range	T_J, T_{STG}		-65 to +150		°C
Thermal Resistance	θ_{JC}		3.47		°C/W

Typical Performance Characteristics

Safe Operating Area Curve

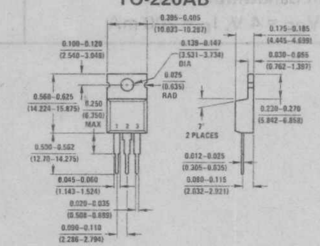


Thermal Derating Curve

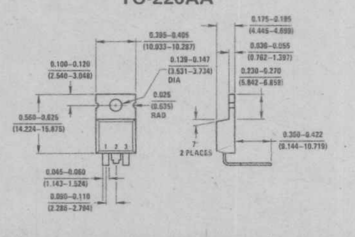


Physical Dimensions

TO-220AB



TO-220AA

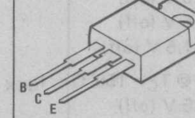
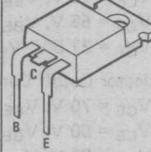


Electrical Characteristics ($T_C = 25°C$ unless noted)

Parameter	Symbol	2N5293 2N5294 Min.	2N5293 2N5294 Max.	2N5295 2N5296 Min.	2N5295 2N5296 Max.	2N5297 2N5298 Min.	2N5297 2N5298 Max.	Units
Collector-Emitter Sustaining Voltage	V_{CEO}							
$I_C = 100$ mA, $I_B = 0$		70		40		60		V
Collector-Emitter Sustaining Voltage	I_{CER}							
$I_C = 100$ mA, $R_{BE} = 100\ \Omega$		75		50		70		V
Collector-Emitter Sustaining Voltage								
$I_C = 100$ mA, $V_{BE} = 1.5$ V (off)		80		60		80		V
Collector Cutoff Current	I_{CEX}							
$V_{CE} = 65$ V, $V_{BE} = 1.5$ V (off)			0.5		–		0.5	mA
$V_{CE} = 35$ V, $V_{BE} = 1.5$ V (off)			–		2		–	
Collector Cutoff Current	I_{CEX}							
$V_{CE} = 65$ V, $V_{BE} = 1.5$ V (off), $T_C = 150°C$			3		–		3	mA
$V_{CE} = 35$ V, $V_{BE} = 1.5$ V (off), $T_C = 150°C$			–		5		–	
Collector Cutoff Current	I_{CER}							
$V_{CE} = 50$ V, $R_{BE} = 100\ \Omega$			0.5		–		0.5	mA
$V_{CE} = 50$ V, $R_{BE} = 100\ \Omega$, $T_C = 150°C$			2		–		2	
Emitter Cutoff Current	I_{EBO}							
$V_{EB} = 7$ V, $I_C = 0$			1		–		–	mA
$V_{EB} = 5$ V, $I_C = 0$			–		1		1	
DC Current Gain	h_{FE}							
$V_{CE} = 4$ V, $I_C = 500$ mA		30	120	–	–	–	–	
$V_{CE} = 4$ V, $I_C = 1$ A		–	–	30	120	–	–	
$V_{CE} = 4$ V, $I_C = 1.5$ A		–	–	–	–	20	80	
Collector Saturation Voltage	$V_{CE(S)}$							
$I_C = 500$ mA, $I_B = 50$ mA			1.0		–		–	V
$I_C = 1$ A, $I_B = 100$ mA			–		1.0		–	
$I_C = 1.5$ A, $I_B = 150$ mA			–		–		1.0	
Base-Emitter "ON" Voltage	$V_{BE(ON)}$							
$V_{CE} = 4$ V, $I_C = 500$ mA			1.1		–		–	V
$V_{CE} = 4$ V, $I_C = 1$ A			–		1.3		–	
$V_{CE} = 4$ V, $I_C = 1.5$ A			–		–		1.5	
Gain Bandwidth Product	f_T							
$V_{CE} = 4$ V, $I_C = 200$ mA		2		2		2		MHz

PNP Power Transistors employing Epitaxial Base Mesa Technology. These devices are designed and manufactured using National's "Epoxy B Concept." They are especially useful in applications involving repeated on-off operation where wide temperature excursions are anticipated. The devices are offered with straight leads or pre-formed for insertion into TO-66 sockets.

PNP Silicon Power Transistors 40 Watts

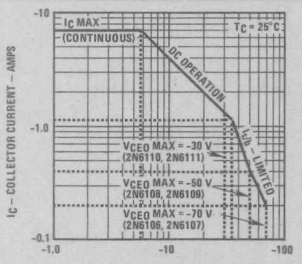
2N6107 2N6109 2N6111	2N6106 2N6108 2N6110
	
TO-220AB	TO-220AA

Maximum Ratings

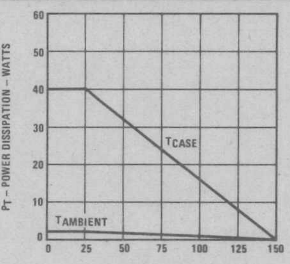
Parameter	Symbol	2N6110 2N6111	2N6108 2N6109	2N6106 2N6107	Units
Collector-Base Voltage	V_{CB}	40	60	80	V
Collector-Emitter Voltage	V_{CEO}	30	50	70	V
Emitter-Base Voltage	V_{EB}		5		V
Collector Current (continuous)	I_C		7		A
Base Current (continuous)	I_B		3		A
Power Dissipation ($T_C = 25°C$) ($T_A = 25°C$)	P_T		40 1.8		W
Temperature Range	T_J, T_{STG}		-65 to +150		°C
Thermal Resistance	θ_{JC} θ_{JA}		3.125 69.4		°C/W

Typical Performance Characteristics

Safe Operating Area Curve

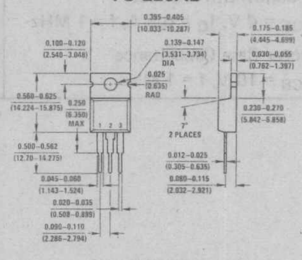


Thermal Derating Curve

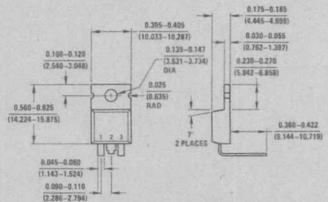


Physical Dimensions

TO-220AB



TO-220AA



Electrical Characteristics ($T_C = 25°C$ unless noted)

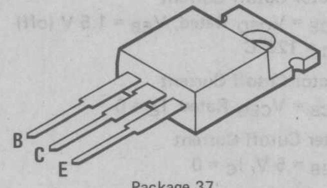
Parameter	Symbol	2N6106/07		2N6108/09		2N6110/11		Units
		Min.	Max.	Min.	Max.	Min.	Max.	
Collector-Emitter Sustaining Voltage	V_{CEO}							
$I_C = 100$ mA, $I_B = 0$		70		50		30		V
Collector-Emitter Sustaining Voltage	V_{CER}							
$I_C = 100$ mA, $R_{BE} = 100\ \Omega$		80		60		40		V
Collector Cutoff Current	I_{CEO}							
$V_{CE} = 60$ V, $I_B = 0$			1.0		–		–	mA
$V_{CE} = 40$ V, $I_B = 0$			–		1.0		–	
$V_{CE} = 20$ V, $I_B = 0$			–		–		1.0	
Collector Cutoff Current	I_{CEX}							
$V_{CE} = 75$ V, $V_{BE} = 1.5$ V (off)			0.1		–		–	mA
$V_{CE} = 56$ V, $V_{BE} = 1.5$ V (off)			–		0.1		–	
$V_{CE} = 37.5$ V, $V_{BE} = 1.5$ V (off)			–		–		0.1	
Collector Cutoff Current @ $T_C = 150°C$	I_{CEX}							
$V_{CE} = 70$ V, $V_{BE} = 1.5$ V (off)			2		–		–	mA
$V_{CE} = 50$ V, $V_{BE} = 1.5$ V (off)			–		2		–	
$V_{CE} = 30$ V, $V_{BE} = 1.5$ V (off)			–		–		2	
Emitter Cutoff Current	I_{EBO}							
$V_{EB} = 5$ V, $I_C = 0$			1.0		1.0		1.0	mA
DC Current Gain	h_{FE}							
$V_{CE} = 4$ V, $I_C = 2$ A		30	150	–	–	–	–	
$V_{CE} = 4$ V, $I_C = 2.5$ A		–	–	30	150	–	–	
$V_{CE} = 4$ V, $I_C = 3$ A		–	–	–	–	30	150	
$V_{CE} = 4$ V, $I_C = 6.5$ A		5		5		5		
Collector Saturation Voltage	$V_{CE(S)}$							
$I_C = 2.0$ A, $I_B = 200$ mA			1.0		–		–	V
$I_C = 2.5$ A, $I_B = 250$ mA			–		1.0		–	
$I_C = 3.0$ A, $I_B = 300$ mA			–		–		1.0	
$I_C = 6.5$ A, $I_B = 1.63$ A			2		2		2	
Base-Emitter "ON" Voltage	$V_{BE(ON)}$							
$V_{CE} = 4$ V, $I_C = 2$ A			1.5					V
$V_{CE} = 4$ V, $I_C = 2.5$ A					1.5			
$V_{CE} = 4$ V, $I_C = 3.0$ A							1.5	
Small Signal Current Gain	h_{fe}							
$V_{CE} = 4$ V, $I_C = 0.5$ A, f = 50 kHz		20		20		20		
Gain Bandwidth Product	f_T							
$V_{CE} = 4$ V, $I_C = 0.5$ A, f = 1 MHz		10		10		10		MHz
Collector-Base Capacitance	C_{ob}							
$V_{CB} = 10$ V, f = 1 MHz			250		250		250	pF

POWER TRANSISTORS

NPN 2N6121 thru 2N6123
PNP 2N6124 thru 2N6126

NPN/PNP Complementary Silicon Power Transistors employing Epi-Base Mesa Technology. These devices are designed and manufactured using National's "Epoxy B Concept." They feature exceptional reliability and are especially useful in applications involving repeated on-off operation where wide temperature excursions are anticipated.

Complementary Silicon Power Transistors 5 Watts/7 Amps



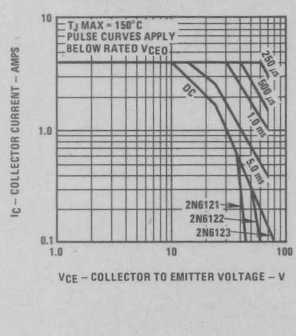
Package 37
TO-220

Maximum Ratings

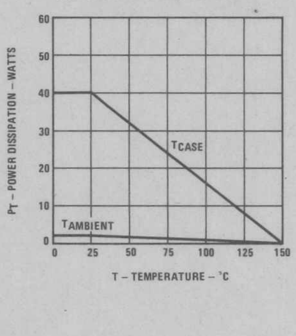
Parameter	Symbol	2N6121 2N6124	2N6122 2N6125	2N6123 2N6126	Units
Collector-Base Voltage	V_{CB}	45	60	80	V
Collector-Emitter Voltage	V_{CEO}	45	60	80	V
Emitter-Base Voltage	V_{EB}		5		V
Collector Current (continuous)	I_C		4		A
Base Current	I_B		1		A
Power Dissipation ($T_C = 25°C$)	P_T		40		W
Derating Factor	$1/\theta_{JC}$		320		MW/°C
Temperature Range	T_J, T_{STG}		-65 to +150		°C

Typical Performance Characteristics

Safe Operating Area Curve

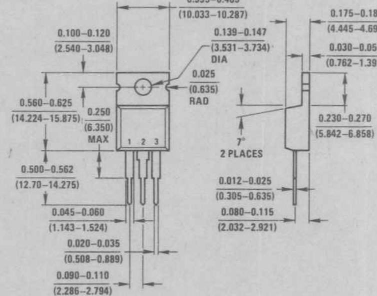


Thermal Derating Curve



Physical Dimensions

TO-220



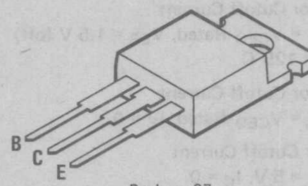
Collector Sustaining Voltage		V_{CEO}			V
$I_C = 100$ mA, $I_B = 0$	2N6121, 24		45		
	2N6122, 25		60		
	2N6123, 26		80		
Collector Cutoff Current		I_{CEO}			mA
$V_{CE} = V_{CEO}$ Rated, $I_B = 0$				1.0	
Collector Cutoff Current		I_{CEX}			mA
$V_{CE} = V_{CEO}$ Rated, $V_{EB} = 1.5$ V (off)				0.1	
Collector Cutoff Current		I_{CEX}			mA
$V_{CE} = V_{CEO}$ Rated, $V_{EB} = 1.5$ V (off) $T_C = 125°C$				2.0	
Collector Cutoff Current		I_{CBO}			mA
$V_{CB} = V_{CEO}$ Rated, $I_E = 0$				0.1	
Emitter Cutoff Current		I_{EBO}			mA
$V_{EB} = 5$ V, $I_C = 0$				1.0	
DC Current Gain		h_{FE1}			
$I_C = 1.5$ A, $V_{CE} = 2$ V	2N6121, 22, 24, 25		20	100	
	2N6123, 26		20	80	
DC Current Gain		h_{FE2}			
$I_C = 4$ A, $V_{CE} = 2$ V	2N6121, 22, 24, 25		10	–	
	2N6123, 26		7	–	
Collector Saturation Voltage		$V_{CE(S)}$			V
$I_C = 1.5$ A, $I_B = 0.15$ A				0.6	
$I_C = 4.0$ A, $I_B = 1$ A				1.4	
Base-Emitter "ON" Voltage		$V_{BE(ON)}$			V
$I_C = 1.5$ A, $V_{CE} = 2$ V				1.2	
Gain-Bandwidth Product		f_T			MHz
$I_C = 1$ A, $V_{CE} = 4$ V, f = 1 MHz			2.5		
Small Signal Current Gain		h_{fe}			
$I_C = 100$ mA, $V_{CE} = 2$ V, f = 1 kHz			25		

POWER TRANSISTORS

NPN 2N6129 thru 2N6131
PNP 2N6132 thru 2N6134

NPN/PNP Complementary Silicon Power Transistors employing Epitaxial Base Mesa Technology. These devices are designed and manufactured using National's "Epoxy B Concept." They feature exceptional reliability and are especially useful in applications involving repeated on-off operation where wide temperature excursions are anticipated.

Complementary Silicon Power Transistors
5 Watts/7 Amps



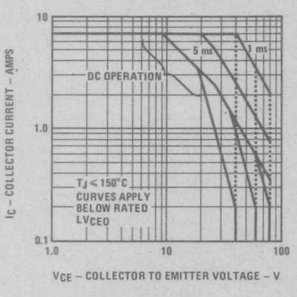
Package 37
TO-220

Maximum Ratings

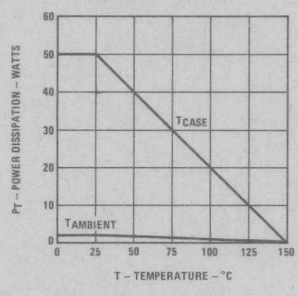
Parameter	Symbol	2N6129 2N6132	2N6130 2N6133	2N6131 2N6134	Units
Collector-Base Voltage	V_{CB}	40	60	80	V
Collector-Emitter Voltage	V_{CEO}	40	60	80	V
Emitter-Base Voltage	V_{EB}	5	5	5	V
Collector Current	I_C	7	7	7	A
Base Current	I_B	3	3	3	A
Power Dissipation ($T_C = 25°C$)	P_T	50	50	50	W
Derating Factor	$1/\theta_{JC}$	400	400	400	MW/°C
Temperature Range	T_J, T_{STG}	-65 to +150	-65 to +150	-65 to +150	°C

Typical Performance Characteristics

Safe Operating Area Curve

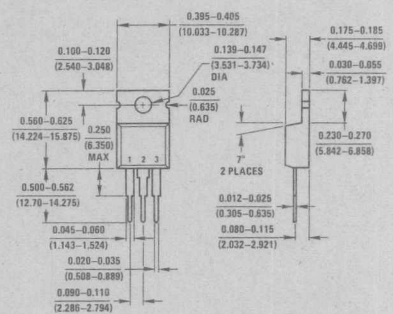


Thermal Derating Curve



Physical Dimensions

TO-220



Electrical Characteristics ($T_C = 25°C$ unless noted)

Parameter	Symbol	Min.	Max.	Units
Collector Sustaining Voltage	V_{CEO}			V
I_C = 100 mA, I_B = 0 — 2N6129, 32		40		
2N6130, 33		60		
2N6131, 34		80		
Collector Cutoff Current $V_{CE} = V_{CEO}$ Rated, $I_B = 0$	I_{CEO}		2	mA
Collector Cutoff Current $V_{CE} = V_{CEO}$ Rated, V_{EB} = 1.5 V (off)	I_{CEX}		0.2	mA
Collector Cutoff Current $V_{CE} = V_{CEO}$ Rated, V_{EB} = 1.5 V (off) $T_C = 125°C$	I_{CEX}		2	mA
Collector Cutoff Current $V_{CB} = V_{CEO}$ Rated, $I_E = 0$	I_{CBO}		0.1	mA
Emitter Cutoff Current V_{EB} = 5 V, I_C = 0	I_{EBO}		1	mA
DC Current Gain I_C = 2.5 A, V_{CE} = 4 V	h_{FE1}	20	100	
DC Current Gain I_C = 7.0 A, V_{CE} = 4 V — 2N6129, 30, 32, 33		7	–	
2N6131, 34		5	–	
Collector Saturation Voltage	$V_{CE(S)}$			V
I_C = 7.0 A, I_B = 3 A — 2N6129, 30, 32, 33		–	1.4	
2N6131, 34		–	2.0	
Base-Emitter "ON" Voltage I_C = 2.5 A, V_{CE} = 4 V	$V_{BE(ON)}$		2.0	V
Gain Bandwidth Product V_{CE} = 4 V, I_C = 1 A, f = 1 MHz	f_T	2.5		MHz
Small Signal Current Gain V_{CE} = 4 V, I_C = 100 mA, f = 1 kHz	h_{fe}	25		

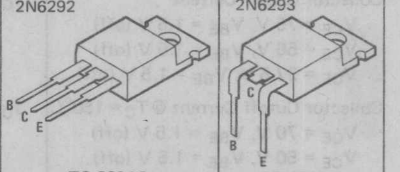
POWER TRANSISTORS

2N6288 thru 2N6293

NPN Power Transistors employing Epitaxial Base Mesa Technology. These devices are designed and manufactured using National's "Epoxy B Concept." They are especially useful in applications involving repeated on-off operation where wide temperature excursions are anticipated. The devices are offered with straight leads or pre-formed for insertion into TO-66 sockets.

NPN Silicon Power Transistors 40 Watts

2N6288 2N6290 2N6292	2N6289 2N6291 2N6293



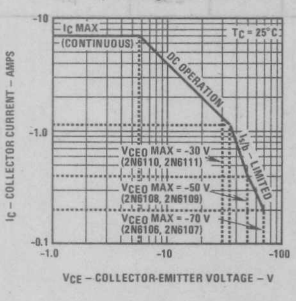
TO-220AB TO-220AA

Maximum Ratings

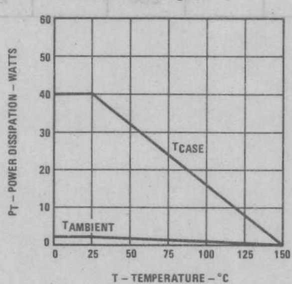
Parameter	Symbol	2N6288 2N6289	2N6290 2N6291	2N6292 2N6293	Units
Collector-Base Voltage	V_{CB}	40	60	80	V
Collector-Emitter Voltage	V_{CEO}	30	50	70	V
Emitter-Base Voltage	V_{EB}		5		V
Collector Current (continuous)	I_C		7		A
Base Current (continuous)	I_B		3		A
Power Dissipation (T_C = 25°C) (T_A = 25°C)	P_T		40 1.8		W
Temperature Range	T_J, T_{STG}		-65 to +150		°C
Thermal Resistance	θ_{JC} θ_{JA}		3.125 69.4		°C/W

Typical Performance Characteristics

Safe Operating Area Curve

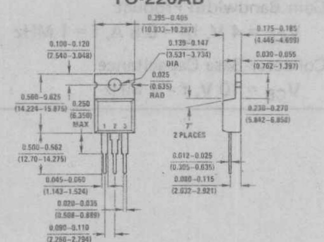


Thermal Derating Curve

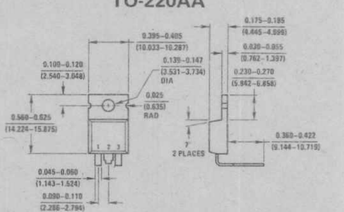


Physical Dimensions

TO-220AB



TO-220AA



3

$I_C = 100$ mA, $I_B = 0$		70		50		30		V
Collector-Emitter Sustaining Voltage	V_{CER}							
$I_C = 100$ mA, $R_{BE} = 100\ \Omega$		80		60		40		V
Collector Cutoff Current	I_{CEO}							
$V_{CE} = 60$ V, $I_B = 0$			1.0		–		–	mA
$V_{CE} = 40$ V, $I_B = 0$			–		1.0		–	
$V_{CE} = 20$ V, $I_B = 0$			–		–		1.0	
Collector Cutoff Current	I_{CEX}							
$V_{CE} = 75$ V, $V_{BE} = 1.5$ V (off)			0.1		–		–	mA
$V_{CE} = 56$ V, $V_{BE} = 1.5$ V (off)			–		0.1		–	
$V_{CE} = 37.5$ V, $V_{BE} = 1.5$ V (off)			–		–		0.1	
Collector Cutoff Current @ $T_C = 150°C$	I_{CEX}							
$V_{CE} = 70$ V, $V_{BE} = 1.5$ V (off)			2		–		–	mA
$V_{CE} = 50$ V, $V_{BE} = 1.5$ V (off)			–		2		–	
$V_{CE} = 30$ V, $V_{BE} = 1.5$ V (off)			–		–		2	
Emitter Cutoff Current	I_{EBO}							
$V_{EB} = 5$ V, $I_C = 0$			1.0		1.0		1.0	mA
DC Current Gain	h_{FE}							
$V_{CE} = 4$ V, $I_C = 2$ A		30	150	–	–	–	–	
$V_{CE} = 4$ V, $I_C = 2.5$ A		–	–	30	150	–	–	
$V_{CE} = 4$ V, $I_C = 3.0$ A		–	–	–	–	30	150	
$V_{CE} = 4$ V, $I_C = 6.5$ A		5		5		5		
Collector Saturation Voltage	$V_{CE(S)}$							
$I_C = 2.0$ A, $I_B = 200$ mA			1.0		–		–	V
$I_C = 2.5$ A, $I_B = 250$ mA			–		1.0		–	
$I_C = 3.0$ A, $I_B = 300$ mA			–		–		1.0	
$I_C = 6.5$ A, $I_B = 1.63$ A			2		2		2	
Base-Emitter "ON" Voltage	$V_{BE(ON)}$							
$V_{CE} = 4$ V, $I_C = 2$ A			1.5					V
$V_{CE} = 4$ V, $I_C = 2.5$ A					1.5			
$V_{CE} = 4$ V, $I_C = 3.0$ A							1.5	
Small Signal Current Gain	h_{fe}							
$V_{CE} = 4$ V, $I_C = 0.5$ A, f = 50 kHz		20		20		20		
Gain Bandwidth Product	f_T							
$V_{CE} = 4$ V, $I_C = 0.5$ A, f = 1 MHz		4		4		4		MHz
Collector-Base Capacitance	C_{ob}							
$V_{CB} = 10$ V, f = 1 MHz			250		250		250	pF

Section 4

TO-126

4

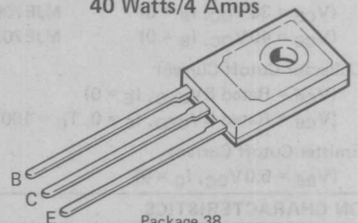
POWER TRANSISTORS

NPN MJE800 thru MJE803
PNP MJE700 thru MJE703

NPN/PNP Complementary Silicon Darlington Power Transistors employing Epitaxial Base Mesa Technology. This series is designed to replace discrete driver and output stages in complementary audio amplifier applications.

The MJE700-703 and MJE800-803 family features National's TO-126 package which is designed and manufactured using National's "Epoxy B Concept." The "Epoxy B Concept" offers exceptional reliability in applications involving repeated on-off operation where wide temperature excursions are anticipated.

Complementary Silicon Power Transistors
40 Watts/4 Amps



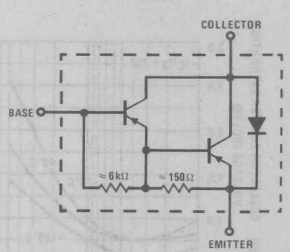
Package 38
TO-126

Maximum Ratings

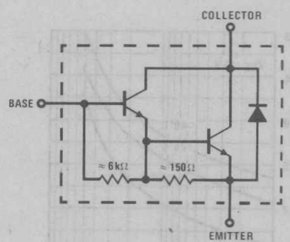
Parameter	Symbol	MJE700, MJE701 MJE800, MJE801	MJE702, MJE703 MJE802, MJE803	Units
Collector-Base Voltage	V_{CB}	60	80	V
Collector-Emitter Voltage	V_{CEO}	60	80	V
Emitter-Base Voltage	V_{EB}	5	5	V
Collector Current (continuous)	I_C	4.0	4.0	A
Base Current	I_B	100	100	mA
Power Dissipation ($T_C = 25°C$)	P_T	40	40	W
($T_A = 25°C$)		1.5	1.5	W
Temperature Range	T_J, T_{STG}	-55 to +150	-55 to +150	°C
Thermal Resistance	θ_{JC}	3.125	3.125	°C/W
	θ_{JA}	83.3	83.3	°C/W

Connection Diagrams

PNP

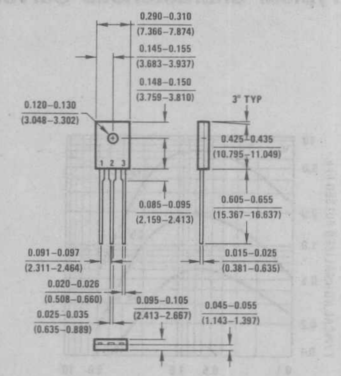


NPN



Physical Dimensions

TO-126



Pin 1. Emitter
2. Collector
3. Base

When mounting the device, torque not to exceed 6.0 in lb.
If lead bending is required, use suitable clamp or other supports between transistor case and point of bend.

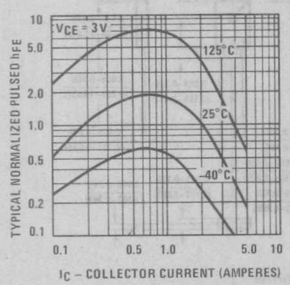
Parameter	Device	Symbol	Min	Max	Units
		BV_{CEO}			V_{DC}
($I_C = 50mA_{DC}$, $I_B = 0$)	MJE700, MJE701, MJE800, MJE801		60	–	
	MJE702, MJE703, MJE802, MJE803		80	–	
Collector Cutoff Current		I_{CEO}			μA_{DC}
($V_{CE} = 30V_{DC}$, $I_B = 0$)	MJE700, MJE701, MJE800, MJE801		–	500	
($V_{CE} = 40V_{DC}$, $I_B = 0$)	MJE702, MJE703, MJE802, MJE803		–	500	
Collector Cutoff Current		I_{CBO}			mA_{DC}
(V_{CB} = Rated BV_{CEO}, $I_E = 0$)			–	0.2	
(V_{CB} = Rated BV_{CEO}, $I_E = 0$, $T_C = 100°C$)			–	2.0	
Emitter Cutoff Current		I_{EBO}			mA_{DC}
($V_{BE} = 5.0V_{DC}$, $I_C = 0$)			–	2.0	
ON CHARACTERISTICS					
DC Current Gain (Note 1)		h_{FE}			–
($I_C = 1.5A_{DC}$, $V_{CE} = 3.0V_{DC}$)	MJE700, MJE702, MJ+800, MJE802		750	–	
($I_C = 2.0A_{DC}$, $V_{CE} = 3.0V_{DC}$)	MJE701, MJE703, MJE801, MJE803		750	–	
Collector-Emitter Saturation Voltage (Note 1)		$V_{CE(sat)}$			V_{DC}
($I_C = 1.5A_{DC}$, $I_B = 30mA_{DC}$)	MJE700, MJE702, MJE800, MJE802		–	2.5	
($I_C = 2.0A_{DC}$, $I_B = 40mA_{DC}$)	MJE701, MJE703, MJE801, MJE803		–	2.8	
Base-Emitter On Voltage (Note 1)		$V_{BE(on)}$			V_{DC}
($I_C = 1.5A_{DC}$, $V_{CE} = 3.0V_{DC}$)	MJE700, MJE702, MJE800, MJE802		–	2.5	
($I_C = 2.0A_{DC}$, $V_{CE} = 3.0V_{DC}$)	MJE701, MJE703, MJE801, MJE803			2.5	
Parallel Diode Forward Voltage Drop		V_F			V_{DC}
($I_C = -4A$, $I_B = 0$)			–	5.0	
DYNAMIC CHARACTERISTICS					
Small Signal Current Gain		h_{fe}			–
($I_C = 1.5A_{DC}$, $V_{CE} = 3.0V_{DC}$, f = 1.0MHz)			1.0	–	

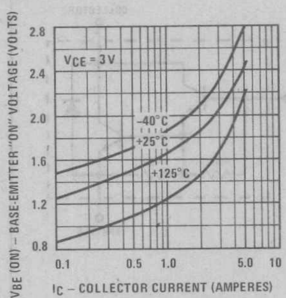
NOTES: 1. Pulse Test: Pulse width ≤ 300μs, duty cycle ≤ 2.0%.

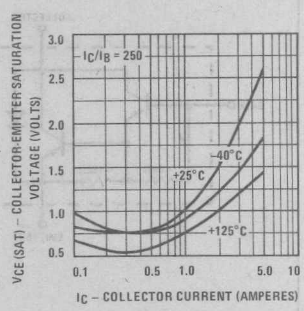
Typical Characteristic Curves

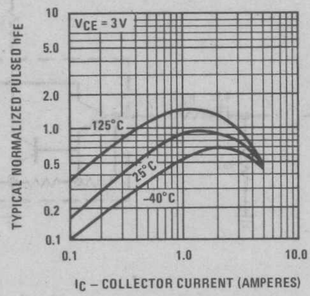
($T_C = 25°C$ unless otherwise noted.)

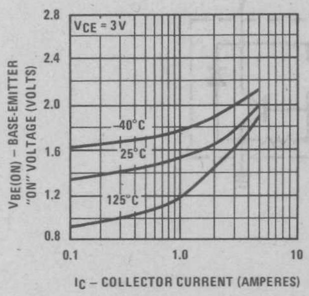
MJE700–MJE703

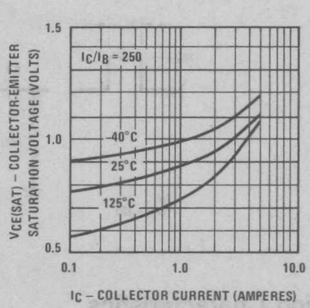


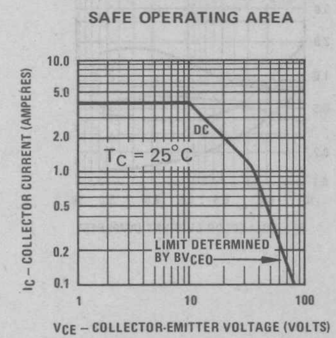


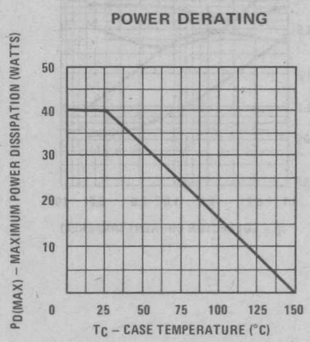



TYPICAL NORMALIZED PULSED hFE
VCE = 3 V
125°C
25°C
-40°C
10
5.0
2.0
1.0
0.5
0.2
0.1
0.1
1.0
10.0
IC – COLLECTOR CURRENT (AMPERES)


VBE(ON) – BASE-EMITTER "ON" VOLTAGE (VOLTS)
VCE = 3 V
-40°C
25°C
125°C
2.8
2.4
2.0
1.6
1.2
0.8
0.1
1.0
10
IC – COLLECTOR CURRENT (AMPERES)


VCE(SAT) – COLLECTOR-EMITTER SATURATION VOLTAGE (VOLTS)
IC/IB = 250
-40°C
25°C
125°C
1.5
1.0
0.5
0.1
1.0
10.0
IC – COLLECTOR CURRENT (AMPERES)

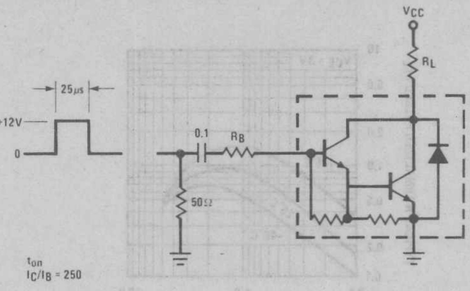

SAFE OPERATING AREA
IC – COLLECTOR CURRENT (AMPERES)
DC
TC = 25°C
LIMIT DETERMINED BY BVCEO
10.0
5.0
2.0
1.0
0.5
0.2
0.1
1
10
100
VCE – COLLECTOR-EMITTER VOLTAGE (VOLTS)


POWER DERATING
PD(MAX) – MAXIMUM POWER DISSIPATION (WATTS)
50
40
30
20
10
0
25
50
75
100
125
150
TC – CASE TEMPERATURE (°C)

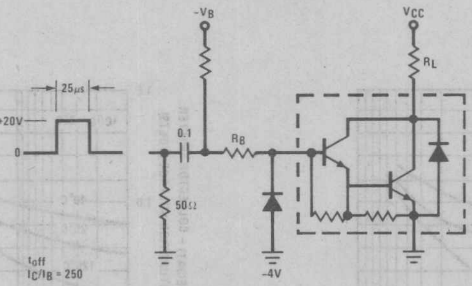
4

Switching Time Test Circuits

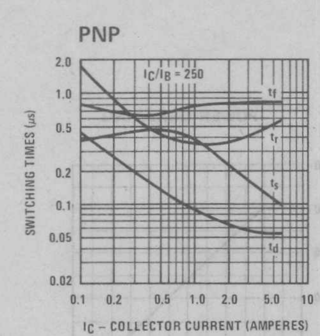
t_{on}

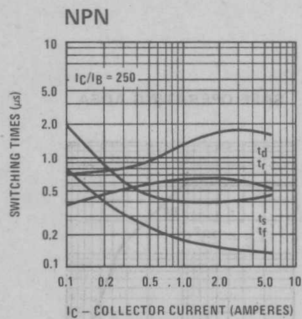


t_{off}



Typical Switching Characteristics





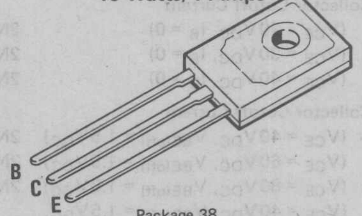
POWER TRANSISTORS

NPN 2N6037 thru 2N6039 PNP 2N6034 thru 2N6036

NPN/PNP Complementary Silicon Darlington Power Transistors employing Epitaxial Base Mesa Technology. This series is designed for general purpose amplifier and low speed switching applications.

The 2N6034-39 family features National's TO-126 package which is designed and manufactured using National's "Epoxy B Concept." The "Epoxy B Concept" offers exceptional reliability in applications involving repeated on-off operation where wide temperature excursions are anticipated.

Complementary Silicon Power Transistors 40 Watts/4 Amps



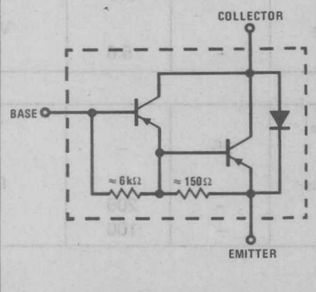
Package 38
TO-126

Maximum Ratings

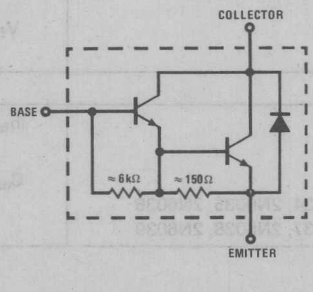
Parameter	Symbol	2N6034 2N6037	2N6035 2N6038	2N6036 2N6039	Units
Collector-Base Voltage	V_{CB}	40	60	80	V
Collector-Emitter Voltage	V_{CEO}	40	60	80	V
Emitter-Base Voltage	V_{EB}	5	5	5	V
Collector Current (continuous)	I_C	4.0	4.0	4.0	A
(peak)		8.0	8.0	8.0	A
Base Current	I_B	100	100	100	mA
Power Dissipation ($T_C = 25°C$)	P_T	40	40	40	W
($T_A = 25°C$)		1.5	1.5	1.5	W
Temperature Range	T_J, T_{STG}	-65 to +150	-65 to +150	-65 to +150	°C
Thermal Resistance	θ_{JC}	3.125	3.125	3.125	°C/W
	θ_{JA}	83.3	83.3	83.3	°C/W

Connection Diagrams

PNP

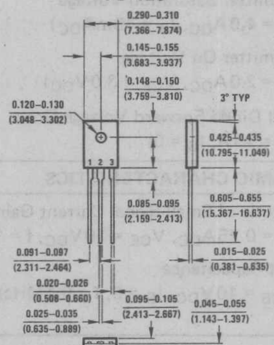


NPN



Physical Dimensions

TO-126



Pin 1. Emitter
2. Collector
3. Base

When mounting the device, torque not to exceed 6.0 in lb.
If lead bending is required, use suitable clamp or other supports between transistor case and point of bend.

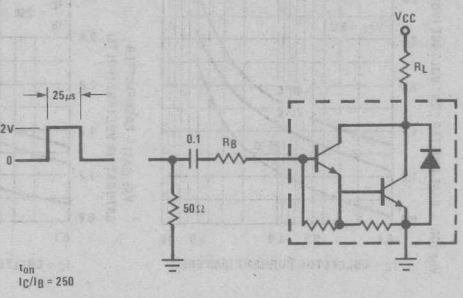
Electrical Characteristics (T_C = 25°C unless otherwise noted.)

Characteristic		Symbol	Min	Max	Units
OFF CHARACTERISTICS					
Collector-Emitter Sustaining Voltage		$V_{CEO(sus)}$			V_{DC}
(I_C = 100 mA_{DC}, I_B = 0	2N6034, 2N6037		40	–	
	2N6035, 2N6038		60	–	
	2N6036, 2N6039		80	–	
Collector Cutoff Current		I_{CEO}			mA_{DC}
(V_{CE} = 20 V_{DC}, I_B = 0)	2N6034, 2N6037		–	0.5	
(V_{CE} = 30 V_{DC}, I_B = 0)	2N6035, 2N6038		–	0.5	
(V_{CE} = 40 V_{DC}, I_B = 0)	2N6036, 2N6039		–	0.5	
Collector Cutoff Current		I_{CEX}			mA_{DC}
(V_{CE} = 40 V_{DC}, $V_{BE(off)}$ = 1.5 V_{DC})	2N6034, 2N6037		–	0.5	
(V_{CE} = 60 V_{DC}, $V_{BE(off)}$ = 1.5 V_{DC})	2N6035, 2N6038		–	0.5	
(V_{CE} = 80 V_{DC}, $V_{BE(off)}$ = 1.5 V_{DC})	2N6036, 2N6039		–	0.5	
(V_{CE} = 40 V_{DC}, $V_{BE(off)}$ = 1.5 V_{DC}, T_C = 125°C)	2N6034, 2N6037		–	2.0	
(V_{CE} = 60 V_{DC}, $V_{BE(off)}$ = 1.5 V_{DC}, T_C = 125°C)	2N6035, 2N6038		–	2.0	
(V_{CE} = 80 V_{DC}, $V_{BE(off)}$ = 1.5 V_{DC}, T_C = 125°C)	2N6036, 2N6039		–	2.0	
Collector Cutoff Current		I_{CBO}			mA_{DC}
(V_{CB} = 40 V_{DC}, I_E = 0)	2N6034, 2N6037		–	0.5	
(V_{CB} = 60 V_{DC}, I_E = 0)	2N6035, 2N6038		–	0.5	
(V_{CB} = 80 V_{DC}, I_E = 0)	2N6036, 2N6039		–	0.5	
Emitter Cutoff Current		I_{EBO}			mA_{DC}
(V_{BE} = 5.0 V_{DC}, I_C = 0)			–	2.0	
ON CHARACTERISTICS					
DC Current Gain		h_{FE}			–
(I_C = 0.5 A_{DC}, V_{CE} = 3.0 V_{DC})			500	–	
(I_C = 2.0 A_{DC}, V_{CE} = 3.0 V_{DC})			750	15,000	
(I_C = 4.0 A_{DC}, V_{CE} = 3.0 V_{DC})			100		
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$			V_{DC}
(I_C = 2.0 A_{DC}, I_B = 8.0 mA_{DC})			–	2.0	
(I_C = 4.0 A_{DC}, I_B = 40 mA_{DC})			–	3.0	
Base-Emitter Saturation Voltage		$V_{BE(sat)}$			V_{DC}
(I_C = 4.0 A_{DC}, I_B = 40 mA_{DC})			–	4.0	
Base-Emitter On Voltage		$V_{BE(on)}$			V_{DC}
(I_C = 2.0 A_{DC}, V_{CE} = 3.0 V_{DC})			–	2.8	
Parallel Diode Forward Voltage Drop		V_F			V_{DC}
(I_C = –4 A, I_B = 0)			–	5.0	
DYNAMIC CHARACTERISTICS					
Magnitude of Small-Signal Current Gain		$\lvert h_{fe} \rvert$			–
(I_C = 0.75 A_{DC}, V_{CE} = 10 V_{DC}, f = 1.0 MHz)			25	–	
Output Capacitance		C_{ob}			pF
(V_{CB} = 10 V_{DC}, I_E = 0, f = 0.1 MHz)	2N6034, 2N6035, 2N6036		–	200	
	2N6037, 2N6038, 2N6039		–	100	

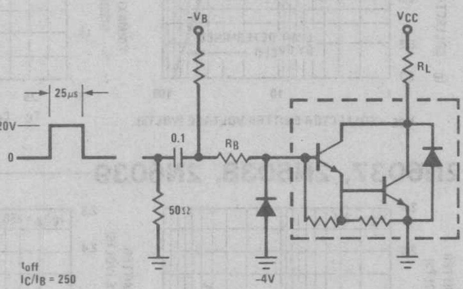
* Indicates JEDEC Registered Data.

Switching Time Test Circuits

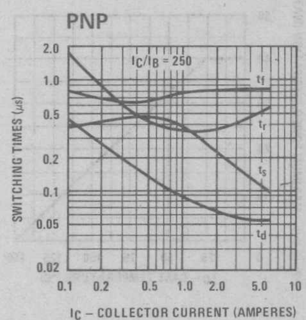
t_{on}

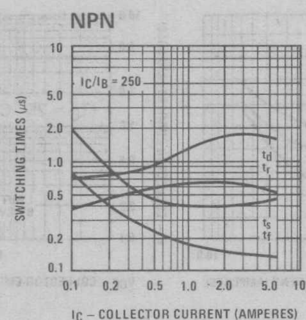


t_{off}

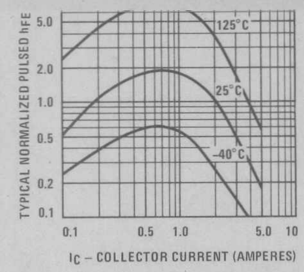


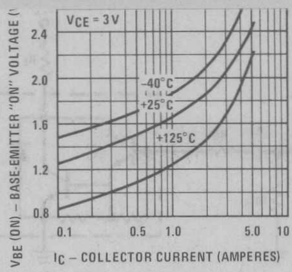
Typical Switching Characteristics

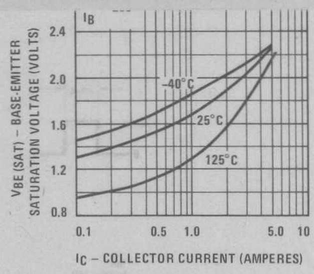


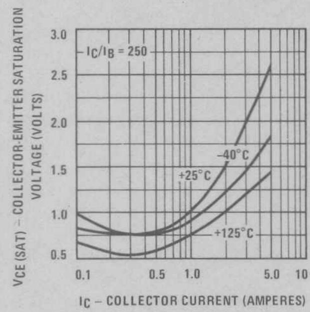


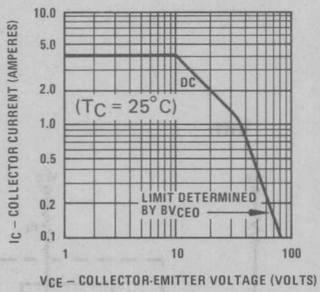
NPN 2N6037 thru9
PNP 2N6034 thru6

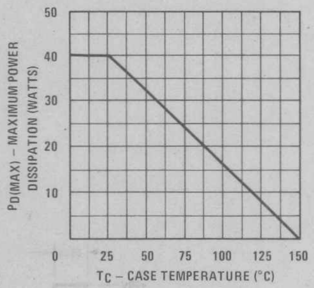




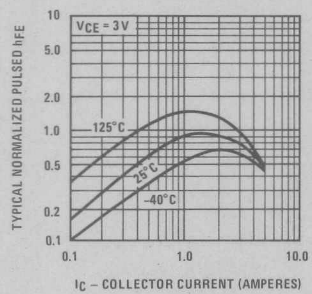


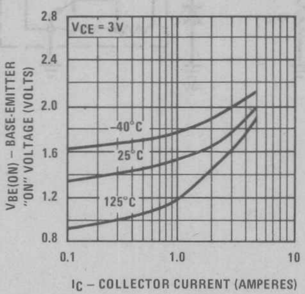


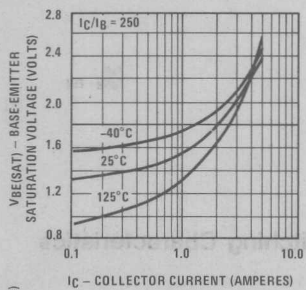


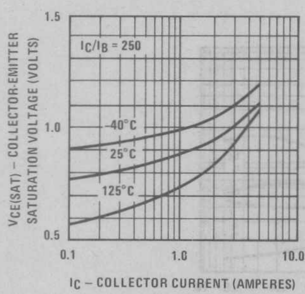


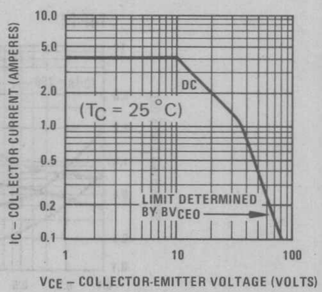
2N6037, 2N6038, 2N6039

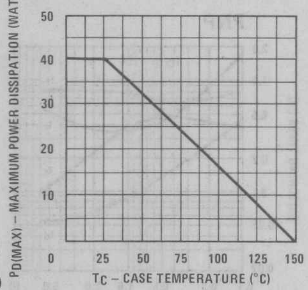












Section 5

TO-3

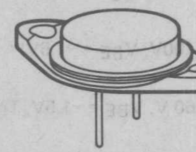
5

POWER TRANSISTORS

NPN 2N3713 thru 2N3716 PNP 2N3789 thru 2N3792

NPN/PNP complementary silicon power transistors are for medium-speed switching and amplifier applications.

Complementary Silicon Power Transistors 150 Watts



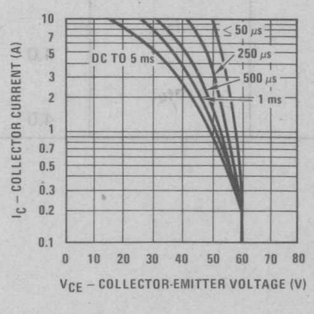
Package 98
TO-3

Maximum Ratings ($T_C = 25°C$ unless otherwise noted)

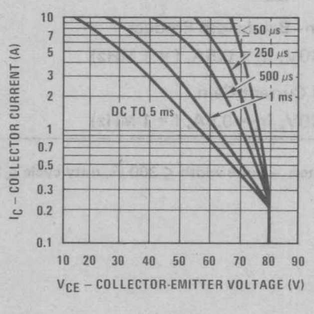
PARAMETER	SYMBOL	2N3713, 2N3715 2N3789, 2N3791	2N3714, 2N3716 2N3790, 2N3792	UNIT
Collector-Base Voltage	V_{CB}	80	100	V
Collector-Emitter Voltage	V_{CEO}	60	80	V
Emitter-Base Voltage	V_{EB}	7.0	7.0	V
Collector Current	I_C	10	10	A
Base Current (Continuous)	I_B	4.0	4.0	A
Power Dissipation	P_D	150	150	W
Thermal Resistance	θ_{JC}	1.17	1.17	°C/W
Junction Operating and Storage Temperature Range	T_J, T_{STG}	−65 to +200	−65 to +200	°C

Typical Performance Characteristics

Safe Operating Area 2N3713, 2N3715, 2N3789 and 2N3791



Safe Operating Area 2N3714, 2N3716, 2N3790 and 2N3792



Electrical Characteristics ($T_C = 25°C$ unless otherwise noted)

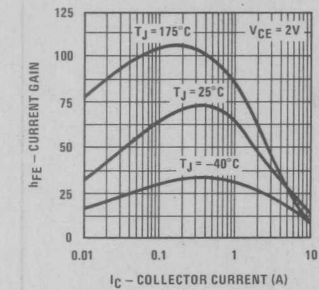
PARAMETER		SYMBOL	MIN	MAX	UNIT
Collector-Emitter Sustaining Voltage (Note 1)		$V_{CEO(SUS)}$			V
($I_C = 20$ mA, $I_B = 0$)	2N3713, 2N3715, 2N3789, 2N3791		60		
	2N3714, 2N3716, 2N3790, 2N3792		80		
Collector-Emitter Cutoff Current		I_{CEX}			mA
($V_{CE} = 80V$, $V_{BE} = -1.5V$)	2N3713, 2N3715, 2N3789, 2N3791			1.0	
($V_{CE} = 100V$, $V_{BE} = -1.5V$)	2N3714, 2N3716, 2N3790, 2N3792			1.0	
($V_{CE} = 60$ V, $V_{BE} = -1.5V$, $T_C = 150°C$)	2N3713, 2N3715,			10	
	2N3789, 2N3791			5.0	
($V_{CE} = 80V$, $V_{BE} = -1.5V$, $T_C = 150°C$)	2N3714, 2N3716			10	
	2N3790, 2N3792			5.0	
Emitter-Base Cutoff Current		I_{EBO}			mA
($V_{EB} = 7V$)				5.0	
DC Current Gain (Note 1)		h_{FE}			
($I_C = 1A$, $V_{CE} = 2V$)	2N3713, 2N3714, 2N3789, 2N3790		25	90	
	2N3715, 2N3716, 2N3791, 2N3792		50	150	
($I_C = 3A$, $V_{CE} = 2V$)	2N3713, 2N3714, 2N3789, 2N3790		15		
	2N3715, 2N3716, 2N3791, 2N3792		30		
Collector-Emitter Saturation Voltage (Note 1)		$V_{CE(SAT)}$			V
($I_C = 4A$, $I_B = 0.4A$)	2N3789, 2N3790			1.0	
($I_C = 5A$, $I_B = 0.5A$)	2N3713, 2N3714			1.0	
	2N3715, 2N3716			0.8	
	2N3791, 2N3792			1.0	
Base-Emitter Saturation Voltage (Note 1)		$V_{BE(SAT)}$			V
($I_C = 4A$, $I_B = 0.4A$)	2N3789, 2N3790			2.0	
($I_C = 5A$, $I_B = 0.5A$)	2N3713, 2N3714			2.0	
	2N3715, 2N3716, 2N3791, 2N3792			1.5	
Base-Emitter Voltage (Note 1)		V_{BE}			V
($I_C = 3A$, $V_{CE} = 2V$)				1.5	
Current Gain—Bandwidth Product		f_T			MHz
($V_{CE} = 10V$, $I_C = 0.5A$, f = 1 MHz)			4.0		
Small Signal Current Gain		h_{fe}			
($V_{CE} = 10V$, $I_C = 0.5A$, f = 1 MHz)			4.0		

Note 1: Pulse test — pulse width $\leq 300\ \mu s$, duty cycle $\leq 2\%$.

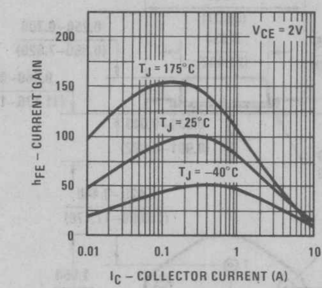
Typical Performance Characteristics (Continued)

2N3713 thru 2N3716

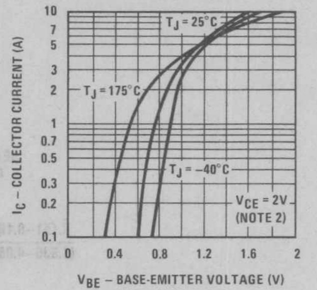
DC Current Gain vs Collector Current 2N3713, 2N3714



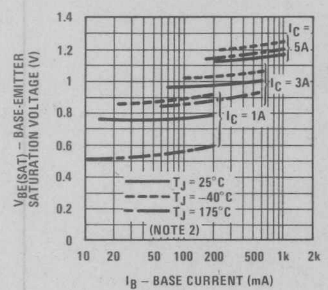
DC Current Gain vs Collector Current 2N3715, 2N3716



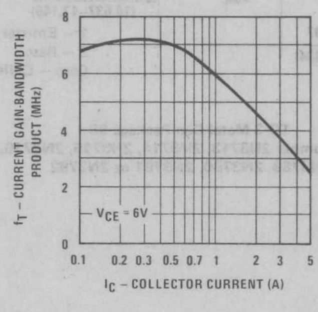
Transconductance



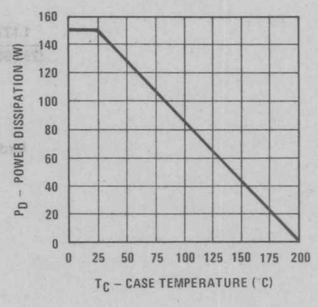
Base-Emitter Saturation Voltage Variations



Gain Bandwidth Product vs Collector Current

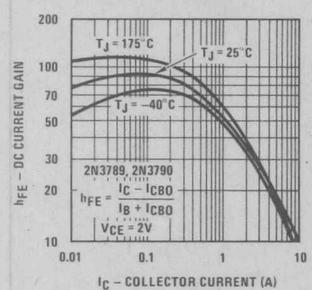


Maximum Power Dissipation vs Case Temperature

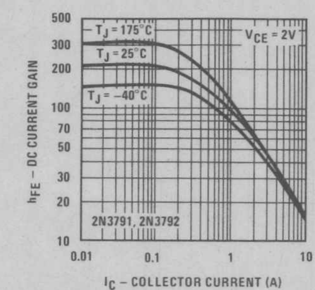


2N3789 thru 2N3792

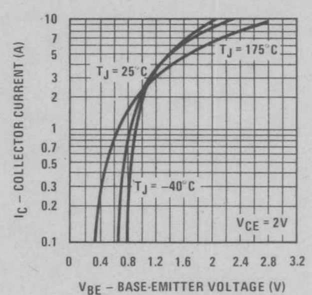
DC Current Gain vs Collector Current 2N3789, 2N3790



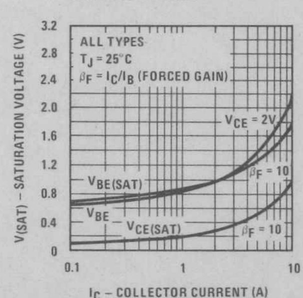
DC Current Gain vs Collector Current 2N3791, 2N3792



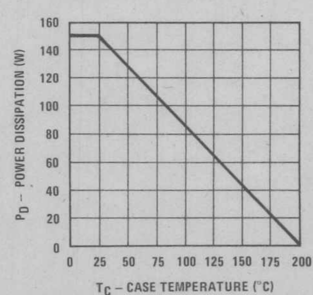
Transconductance



Forward Characteristics vs Collector Current



Maximum Power Dissipation vs Case Temperature



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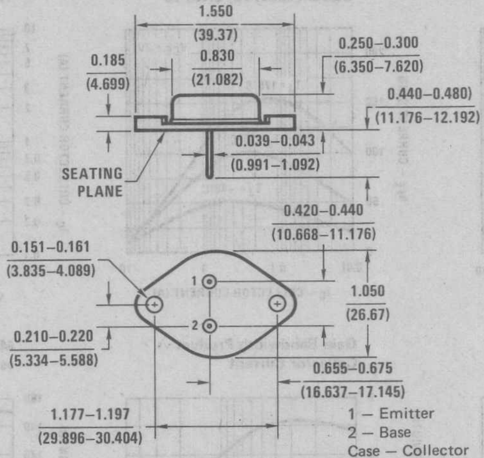
Physical Dimensions



TO-3 Metal Can Package 98
Order Number 2N3713, 2N3714, 2N3715, 2N3716, 2N3789, 2N3790, 2N3791 or 2N3792

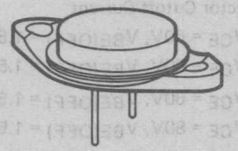
POWER TRANSISTORS

NPN 2N5873, 2N5874
PNP 2N5871, 2N5872

These complementary silicon power transistors are designed for general purpose power amplifier and switching applications.

- Low collector-emitter saturation voltage—$V_{CE}(sat)$ = 1.0 V_{DC} max, @ I_C = 4.0 A_{DC}
- Low leakage current — I_{CEX} = 0.25 mA_{DC} max
- Excellent dc current gain—h_{FE} = 20 min, @ I_C = 2.5 A_{DC}
- High current gain—bandwidth product—f_T = 4.0 MHz @ I_C = 0.25 A_{DC}

Complementary Silicon Power Transitors 115 Watts



Package 98
TO-3

Maximum Ratings

PARAMETER	SYMBOL	2N5871 2N5873	2N5872 2N5874	UNIT
Collector-Emitter Voltage	V_{CEO}	60	80	V
Collector-Base Voltage	V_{CB}	60	80	V
Emitter-Base Voltage	V_{EB}	5.0	5.0	V
Collector Current—Continuous	I_C	7.0	7.0	A
Peak		15	15	A
Base Current	I_B	2.0	2.0	A
Total Device Dissipation @ T_C = 25°C	P_D	115		W
Derate above 25°C		0.658		W/°C
Operating and Storage Junction Temperature Range	T_J, T_{STG}	−65 to +200	−65 to +200	°C

Thermal Characteristics

PARAMETER	SYMBOL	MAX	UNIT
Thermal Resistance, Junction to Case	θ_{JC}	1.52	°C/W

Note 1: Indicates JEDEC registered data. All above values meet or exceed present JEDEC registered data.

$(I_C = 100\ mA, I_B = 0)$	2N5871, 2N5873		60		
	2N5872, 2N5874		80		
Collector Cutoff Current		I_{CEO}			mA
$(V_{CE} = 30V, I_B = 0)$	2N5871, 2N5873			0.5	
$(V_{CE} = 40V, I_B = 0)$	2N5872, 2N5874			0.5	
Collector Cutoff Current		I_{CEX}			mA
$(V_{CE} = 60V, V_{BE(OFF)} = 1.5V)$	2N5871, 2N5873			0.25	
$(V_{CE} = 80V, V_{BE(OFF)} = 1.5V)$	2N5872, 2N5874			0.25	
$(V_{CE} = 60V, V_{BE(OFF)} = 1.5V, T_C = 150^\circ C)$	2N5871, 2N5873			2.0	
$(V_{CE} = 80V, V_{BE(OFF)} = 1.5V, T_C = 150^\circ C)$	2N5872, 2N5874			2.0	
Collector Cutoff Current		I_{CBO}			mA
$(V_{CB} = 60V, I_E = 0)$	2N5871, 2N5873			0.25	
$(V_{CB} = 80V, I_E = 0)$	2N5872, 2N5874			0.25	
Emitter Cutoff Current $(V_{EB} = 5.0V, I_C = 0)$		I_{EBO}		1.0	mA
ON CHARACTERISTICS					
dc Current Gain (Note 1)		h_{FE}			
$(I_C = 0.5A, V_{CE} = 4V)$			35		
$(I_C = 2.5A, V_{CE} = 4V)$			20	100	
$(I_C = 7A, V_{CE} = 4V)$			4.0		
Collector-Emitter Saturation Voltage (Note 1)		$V_{CE(sat)}$			V
$(I_C = 4V, I_B = 0.4A)$				1.0	
$(I_C = 7A, I_B = 1.75A)$				2.0	
Base-Emitter Saturation Voltage (Note 1) $(I_C = 7A, I_B = 1.75A)$		$V_{BE(sat)}$		2.5	V
Base-Emitter ON Voltage (Note 1) $(I_C = 2.5A, V_{CE} = 4V)$		$V_{BE(on)}$		1.5	V
DYNAMIC CHARACTERISTICS					
Current-Gain—Bandwidth Product (Note 2) $(I_C = 0.25A, V_{CE} = 10V, f_{test} = 1\ MHz)$		f_T	4.0		MHz
Output Capacitance		C_{ob}			pF
$(V_{CB} = 10V, I_E = 0, f = 1\ MHz)$	2N5871, 2N5872			300	
	2N5873, 2N5874			200	
Small-Signal Current Gain $(I_C = 0.5A, V_{CE} = 4V, f = 1\ kHz)$		h_{fe}	20		

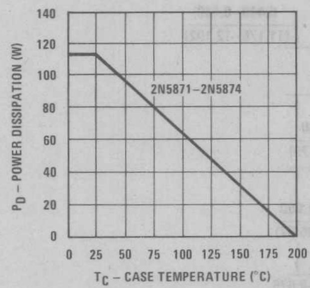
*Indicates JEDEC registered data

Note 1: Pulse test: pulse width $\leq 300\ \mu s$, duty cycle $\leq 2\%$.

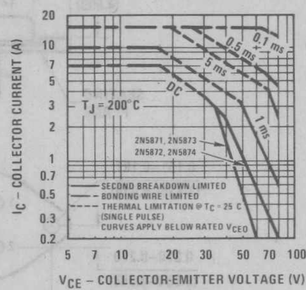
Note 2: $f_T = |h_{fe}| \cdot f_{test}$.

Typical Performance Characteristics

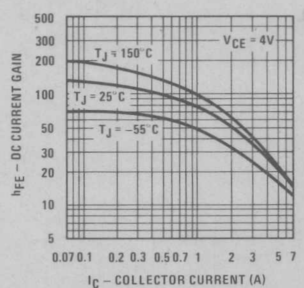
Maximum Power Dissipation vs Case Temperature



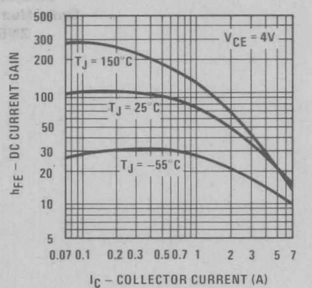
Safe Operating Area



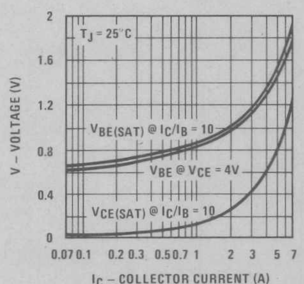
DC Current Gain vs Collector Current 2N5871, 2N5872



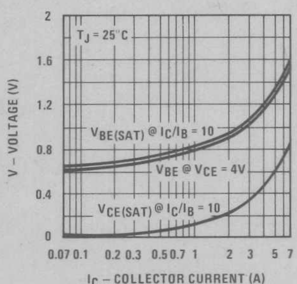
DC Current Gain vs Collector Current 2N5873, 2N5874



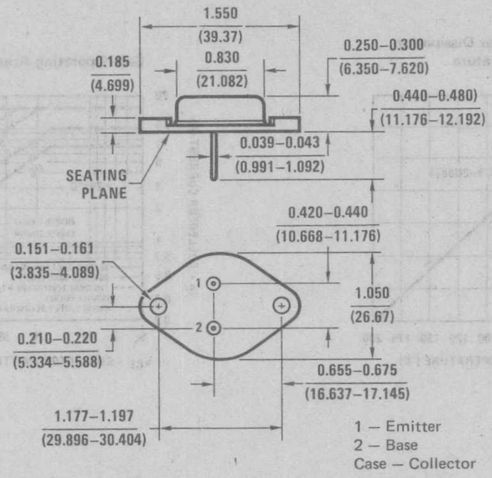
Forward Characteristics vs Collector Current 2N5871, 2N5872



Forward Characteristics vs Collector Current 2N5873, 2N5874



Physical Dimensions

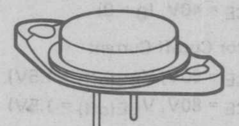


TO-3 Metal Can Package 98
Order Number 2N5871, 2N5872, 2N5873 or 2N5874

These complementary silicon high power and power transistors are designed for general-purpose power amplifier and switching applications.

- Collector-emitter sustaining voltage
  $V_{CEO(sus)}$ = 60V min – 2N5879, 2N5881
  = 80V min – 2N5880, 2N5882
- dc current gain—h_{FE} = 20 min @ I_C = 6A
- Low collector—emitter saturation voltage—$V_{CE(sat)}$ = 1V max @ I_C = 7A
- High current—gain-bandwidth product—f_T = 4 MHz min @ I_C = 1A
- Recommended for new circuit designs

Complementary Silicon Power Transistors 160 Watts



Package 98
TO-3

Maximum Ratings*

PARAMETER	SYMBOL	2N5879 2N5881	2N5880 2N5882	UNIT
Collector-Emitter Voltage	V_{CEO}	60	80	V
Collector-Base Voltage	V_{CB}	60	80	V
Emitter-Base Voltage	V_{EB}	5.0	5.0	V
Collector Current — Continuous	I_C	15	15	A
Peak		30	30	
Base Current	I_B	5.0	5.0	A
Total Device Dissipation @ $T_C = 25^\circ C$	P_D	160	160	W
Derate above 25°C		0.915	0.915	W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−65 to +200	−65 to +200	°C

Thermal Characteristics

PARAMETER	SYMBOL	MAX	UNIT
Thermal Resistance, Junction to Case	θ_{JC}	1.1	°C/W

*Indicates JEDEC registered data. Limits and conditions differ on some parameters and re-registration reflecting these changes has been requested. All above values meet or exceed present JEDEC registered data.

Electrical Characteristics* (T_C = 25°C unless otherwise noted)

PARAMETER		SYMBOL	MIN	MAX	UNIT
OFF CHARACTERISTICS					
Collector-Emitter Sustaining Voltage (Note 1)		$V_{CEO(sus)}$			V
I_C = 200 mA, I_B = 0)	2N5879, 2N5881		60		
	2N5880, 2N5882		80		
Collector Cutoff Current		I_{CEO}			mA
(V_{CE} = 30V, I_B = 0)	2N5879, 2N5881			1.0	
(V_{CE} = 40V, I_B = 0)	2N5880, 2N5882			1.0	
Collector Cutoff Current		I_{CEX}			mA
(V_{CE} = 60V, $V_{BE(off)}$ = 1.5V)	2N5879, 2N5881			0.5	
(V_{CE} = 80V, $V_{BE(off)}$ = 1.5V)	2N5880, 2N5882			0.5	
(V_{CE} = 60V, $V_{BE(off)}$ = 1.5V, T_C = 150°C)	2N5879, 2N5881			5.0	
(V_{CE} = 80V, $V_{BE(off)}$ = 1.5V, T_C = 150°C)	2N5880, 2N5882			5.0	
Collector Cutoff Current		I_{CBO}			mA
(V_{CB} = 60V, I_E = 0)	2N5879, 2N5881			0.5	
(V_{CB} = 80V, I_E = 0)	2N5880, 2N5882			0.5	
Emitter Cutoff Current (V_{EB} = 5V, I_C = 0)		I_{EBO}		1.0	mA
ON CHARACTERISTICS					
DC Current Gain (Note 1)		h_{FE}			
(I_C = 2A, V_{CE} = 4V)			35		
(I_C = 6A, V_{CE} = 4V)			20	100	
(I_C = 15A, V_{CE} = 4V)			4.0		
Collector-Emitter Saturation Voltage (Note 1)		$V_{CE(sat)}$			V
(I_C = 7A, I_B = 0.7A)				1.0	
(I_C = 15A, I_B = 3.75A)				4.0	
Base-Emitter Saturation Voltage (Note 1) (I_C = 15A, I_B = 3.75A)		$V_{BE(sat)}$		2.5	V
Base-Emitter On Voltage (Note 1) (I_C = 6A, V_{CE} = 4V)		$V_{BE(on)}$		1.5	V
DYNAMIC CHARACTERISTICS					
Current Gain—Bandwidth Product (Note 2) (I_C = 1A, V_{CE} = 10V, f_{test} = 1 MHz)		f_T	4.0		MHz
Output Capacitance		C_{ob}			pF
(V_{CB} = 10V, I_E = 0, f = 100 kHz)	2N5879, 2N5880			600	
	2N5881, 2N5882			400	
Small-Signal Current Gain (I_C = 2A, V_{CE} = 4V, f = 1 kHz)		h_{fe}	20		

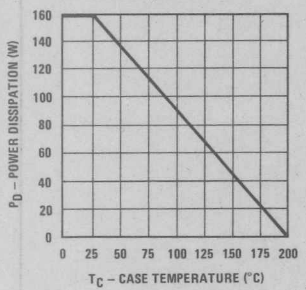
*Indicates JEDEC registered data

Note 1: Pulse test: pulse width ≤ 300 μs, duty cycle ≤ 2%.

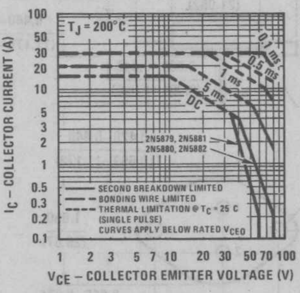
Note 2: $f_T = |h_{fe}| \cdot f_{test}$.

Typical Performance Characteristics

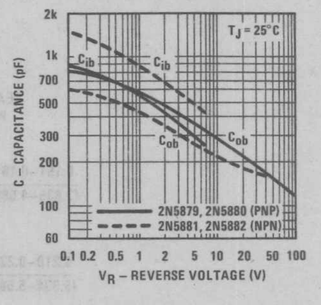
Maximum Power Dissipation vs Case Temperature



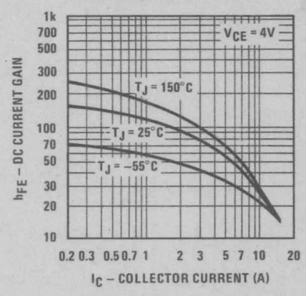
Safe Operating Area



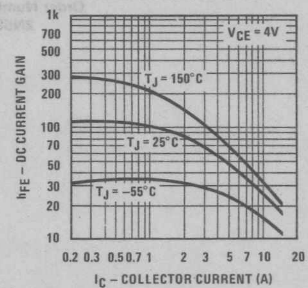
Junction Capacitance vs Reverse Voltage



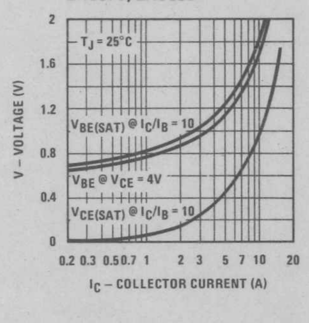
DC Current Gain vs Collector Current 2N5879, 2N5880



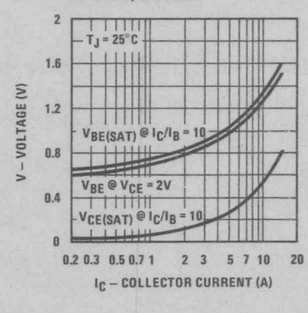
DC Current Gain vs Collector Current 2N5881, 2N5882



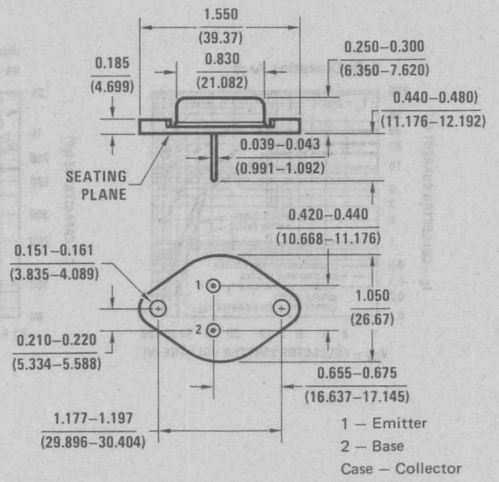
Forward Characteristics vs Collector Current 2N5879, 2N5880



Forward Characteristics vs Collector Current 2N5881, 2N5882



Physical Dimensions



TO-3 Metal Can Package 98
Order Number 2N5879, 2N5880,
2N5881 or 2N5882

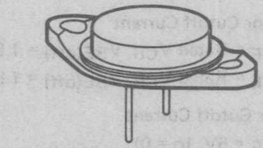
POWER TRANSISTORS

NPN 2N6055, 2N6056
PNP 2N6053, 2N6054

These Darlington complementary silicon power transistors are designed for general-purpose amplifier and low-speed switching applications.

- High dc current gain — h_{FE} = 3000 typ @ I_C = 4A
- Collector-emitter sustaining voltage — @ 100 mA
  $V_{CEO(sus)}$ = 60V min — 2N6053, 2N6055, 2N6298, 2N6300
  = 80V min — 2N6054, 2N6056, 2N6299, 2N6301
- Low collector-emitter saturation voltage
  $V_{CE(sat)}$ = 2V max @ I_C = 4A
  = 3V max @ I_C = 8A
- Monolithic construction with built-in base-emitter shunt resistors

Darlington Complementary Silicon Power Transistors 100 Watts



Package 98
TO-3

Maximum Ratings*

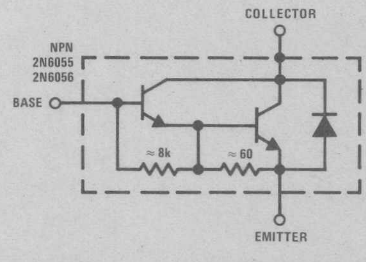
PARAMETER	SYMBOL	2N6053 2N6055	2N6054 2N6056	UNIT
Collector-Emitter Voltage	V_{CEO}	60	80	V
Collector-Base Voltage	V_{CB}	60	80	V
Emitter-Base Voltage	V_{EB}	5.0	5.0	V
Collector Current—Continuous	I_C	8.0	8.0	A
—Peak		16	16	
Base Current	I_B	120	120	mA
Total Device Dissipation @ T_C = 25°C	P_D	100	75	W
Derate Above 25°C		0.571	0.428	W/°C
Operating and Storage Junction Temperature Range	T_J, T_{STG}	−65 to +200	−65 to +200	°C

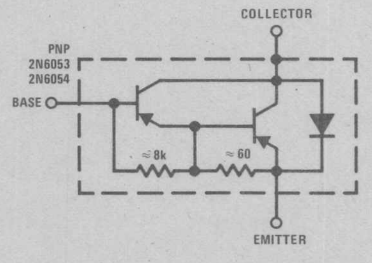
Thermal Characteristics

PARAMETER	SYMBOL	MAX	UNIT
Thermal Resistance, Junction to Case	θ_{JC}	1.75	°C/W

*Indicates JEDEC registered data

Schematic Diagrams





Electrical Characteristics (continued)

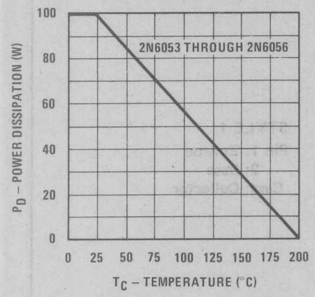
		$V_{CEO(sus)}$			V
(I_C = 100 mA, I_B = 0)	2N6053, 2N6055		60		
	2N6054, 2N6056		80		
Collector Cutoff Current		I_{CEO}			mA
(V_{CE} = 30V, I_B = 0)	2N6053, 2N6055			0.5	
(V_{CE} = 40V, I_B = 0)	2N6054, 2N6056			0.5	
Collector Cutoff Current		I_{CEX}			mA
(V_{CE} = Rated V_{CB}, $V_{BE(off)}$ = 1.5V)				0.5	
(V_{CE} = Rated V_{CB}, $V_{BE(off)}$ = 1.5V, T_C = 150°C				5.0	
Emitter Cutoff Current		I_{EBO}			mA
(V_{BE} = 5V, I_C = 0)				2.0	
ON CHARACTERISTICS (Note 1)					
dc Current Gain		h_{FE}			
(I_C = 4A, V_{CE} = 3V)			750	18000	
(I_C = 8A, V_{CE} = 3V)			100		
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$			V
(I_C = 4A, I_B = 16 mA)				2.0	
(I_C = 8A, I_B = 80 mA)				3.0	
Base-Emitter Saturation Voltage		$V_{BE(sat)}$			V
(I_C = 8A, I_B = 80 mA)				4.0	
Base-Emitter On Voltage		$V_{BE(on)}$			V
(I_C = 4A, V_{CE} = 3V)				2.8	V
DYNAMIC CHARACTERISTICS					
Magnitude of Common Emitter Small-Signal Short-Circuit Current Transfer Ratio		$\|h_{fe}\|$			
(I_C = 3A, V_{CE} = 3V, f = 1 MHz)			4.0		
Output Capacitance		C_{ob}			pF
(V_{CB} = 10V, I_E = 0, f = 0.1 MHz)	2N6053, 2N6054			300	
	2N6055, 2N6056			200	
Small-Signal Current Gain		h_{fe}			
(I_C = 3A, V_{CE} = 3V, f = 1 kHz)			300		

*Indicates JEDEC registered data

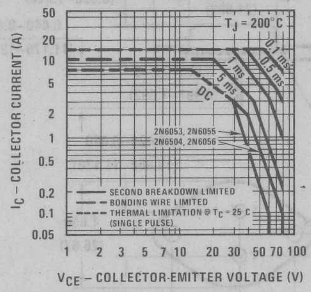
Note 1: Pulse test: pulse width = 300 μs, duty cycle ≤ 2%.

Typical Performance Characteristics

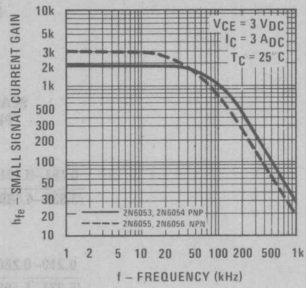
Maximum Power Dissipation vs Case Temperature



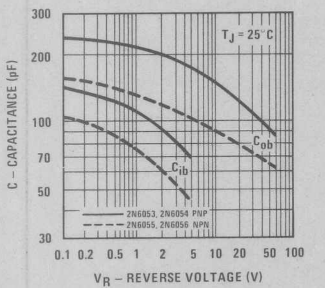
Safe Operating Area



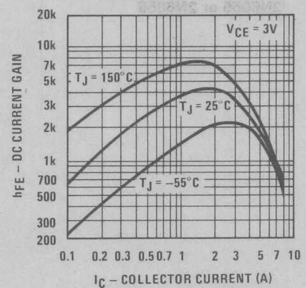
Small Signal Current Gain



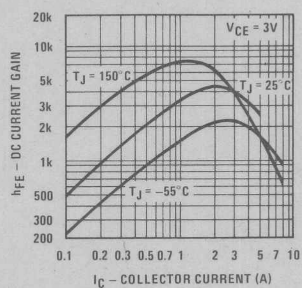
Junction Capacitance vs Reverse Voltage



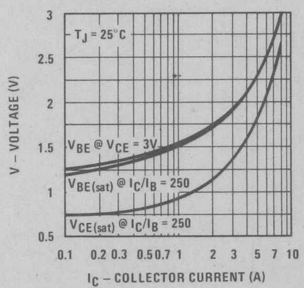
dc Current Gain vs Collector Current 2N6053, 2N6054



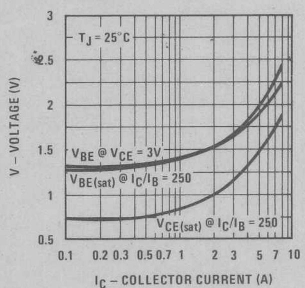
dc Current Gain vs Collector Current 2N6055, 2N6056



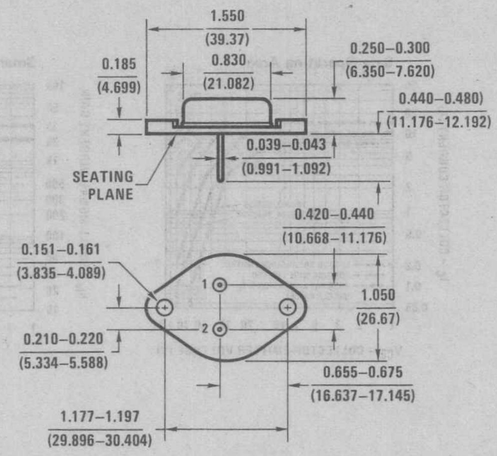
Forward Characteristics vs Collector Current 2N6053, 2N6054



Forward Characteristics vs Collector Current 2N6055, 2N6056



Physical Dimensions



STYLE 1:
Pin 1: Emitter
2: Base
Case: Collector

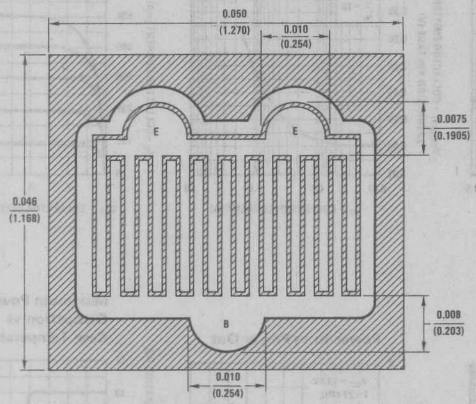
TO-3 Metal Can Package 98
Order Number 2N6053, 2N6054, 2N6055 or 2N6056

Section 6

Processes

6

Process 35 NPN RF-HF Power Amplifier



DESCRIPTION

Process 35 is a double diffused silicon epitaxial device.

APPLICATION

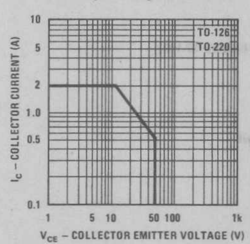
This device is designed for use in the output stage of 4W AM Citizens Band (27 MHz) transmitters with capabilities to withstand infinite VSWR at rated output.

PRINCIPAL DEVICE TYPES:

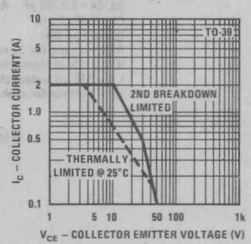
TO-39	MRF8004
TO-126	MRF472
TO-220	2SC1678

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
P_{OUT}	f = 27 MHz, I_C (Avg) = 415 mA, *(Figure 1)*	3.0	3.5		W
η	V_{CC} = 12V, P_{IN} = 0.4W	60	70		%
h_{fe}	I_C = 100 mA, V_{CE} = 5V, f = 20 MHz	6.0	12		
C_{ob}	V_{CB} = 10V		25	35	pF
H_{FE}	I_C = 100 mA, V_{CE} = 1V	30	70	150	
V_{CES}	I_C = 1.0A, I_B = 100 mA		0.2	0.5	V
BV_{CER}	I_C = 1 mA, R_{BE} = 10Ω	65			V
BV_{EBO}	I_E = 100 μA	3			V
I_{CBO}	V_{CB} = 40V			10	μA
I_{CEO}	V_{CE} = 40V			100	μA
I_{EBO}	V_{EB} = 2.0V			10	μA
SOA	V_{CE} = 30V, t = 1 sec	500			mA

Safe Operating Area Curve

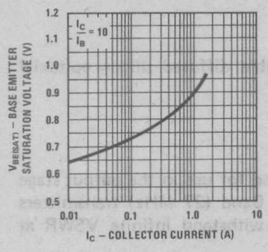


Safe Operating Area Curve

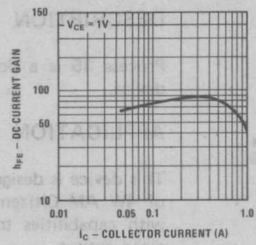


Process 35

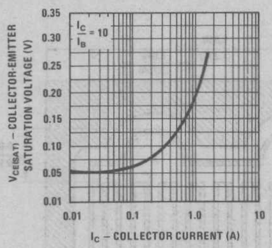
Base-Emitter Saturation Voltage vs Collector Current



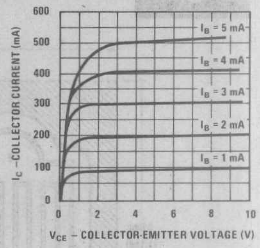
DC Current Gain vs Collector Current



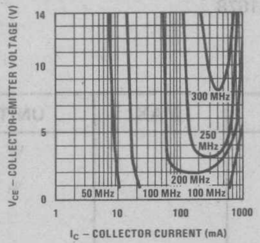
Collector-Emitter Saturation Voltage vs Collector Current



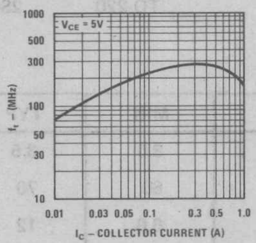
I_C vs V_{CE}



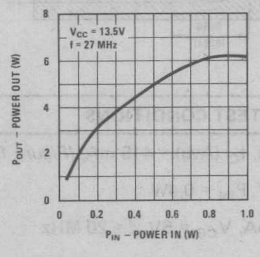
Contours of Constant Gain Bandwidth Product (f_t)



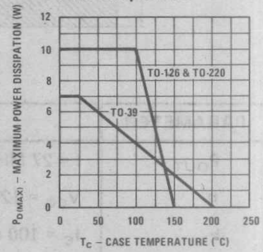
f_t vs I_C

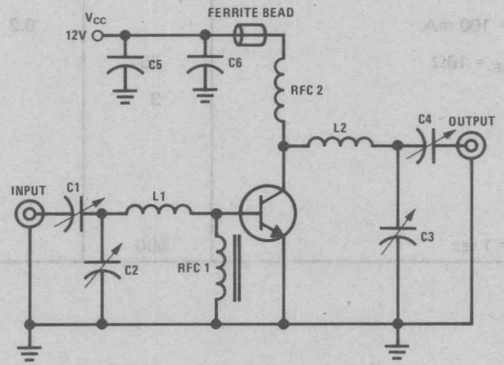


Power In vs Power Out



Maximum Power Dissipation vs Case Temperature

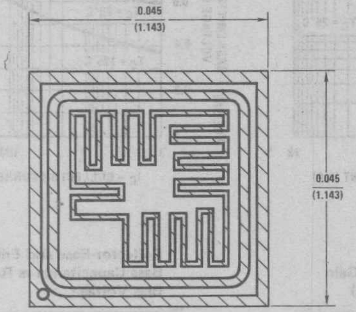




C1, C2 = 9.0–180 pF ARCO 463
C3, C4 = 5.0–80 pF ARCO 462
C5 = 0.01 μF Disc
C6 = 0.1 μF Disc
RFC 1 4 turns No. 32 enameled wire wound on Indiana General Bead No. 57-1692
RFC 2 15 μH chock J.W. Miller #4624
L1 – 0.22 μH molded choke
L2 – 1 μH molded choke

FIGURE 1. 27 MHz Test Circuit

Process 36 NPN High Voltage Power



DESCRIPTION

Process 36 a non-overlay double-diffused silicon epitaxial device.

APPLICATION

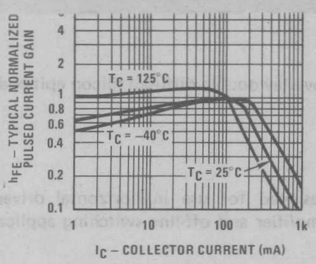
This device is designed for use in horizontal driver, class A off-line amplifier and off-line switching applications.

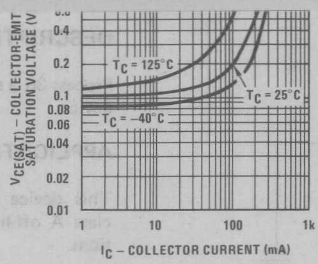
AVAILABLE DEVICE TYPES

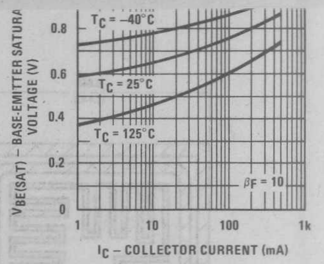
2N5655	MJE340	MJE343
2N5656	MJE341	MJE344
2N5657	MJE342	

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
BV_{CEO}	I_{CE} = 1 mA*	200	300		V
BV_{CBO}	I_{CB} = 100 μA	225	325		V
BV_{EBO}	I_{EB} = 10 μA	6			V
I_{CEO}	V_{CE} = 200V			50	μA
I_{CBO}	V_{CB} = 225V			1	μA
I_{EBO}	V_{EB} = 5V			1	μA
H_{FE}	I_C = 50 mA, V_{CE} = 10V*	25	190		
	I_C = 100 mA, V_{CE} = 10V*	30	200	300	
	I_C = 250 mA, V_{CE} = 10V*	15	60		
	I_C = 500 mA, V_{CE} = 10V*	10	25		
$V_{CE(SAT)}$	I_C = 100 mA, I_B = 10 mA*		0.08	0.5	V
$V_{CE(SAT)}$	I_C = 500 mA, I_B = 100 mA*		0.175	0.5	V
$V_{BE(SAT)}$	I_C = 500 mA, I_B = 100 mA*		0.9	1.2	V
$V_{BE(ON)}$	I_C = 100 mA, V_{CE} = 10V*		0.7	1.0	V
f_t	I_C = 50 mA, V_{CE} = 10V, f = 20 MHz	10	60		MHz
C_{ob}	V_{CB} = 10V			15	pF
C_{ib}	V_{BE} = 0.5V			125	pF
I_{SB}	V_{CE} = 100V, T = 1 second	200			mA
$P_{D(MAX)}$	TO-126			25	W
	TO-202			15	W
θ_{jc}	TO-126			5.0	°C/W
	TO-202			8.33	°C/W
θ_{jA}	TO-202			69.4	°C/W

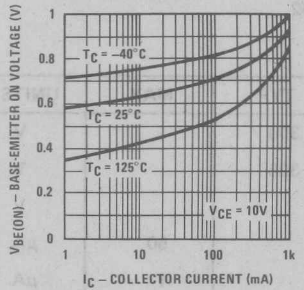
*Pulse test, pulse width = 300 μs



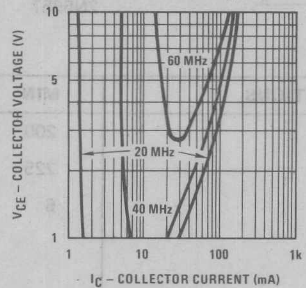




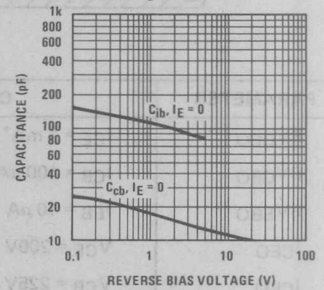
Base-Emitter ON Voltage vs Collector Current



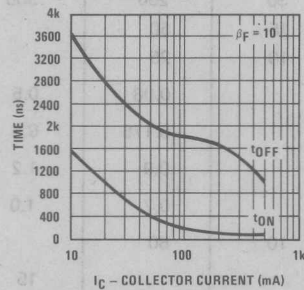
Contours of Constant Gain Bandwidth Product (f_t)



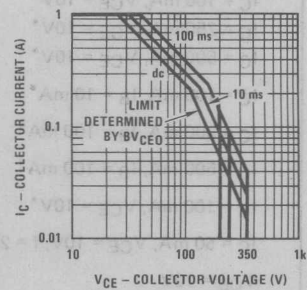
Collector-Base and Emitter-Base Capacitance vs Reverse Bias Voltage



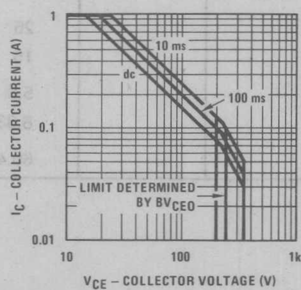
Typical Switching Time vs Collector Current



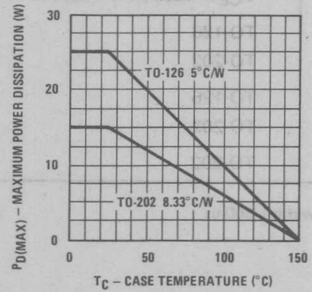
Safe Operating Area TO-126



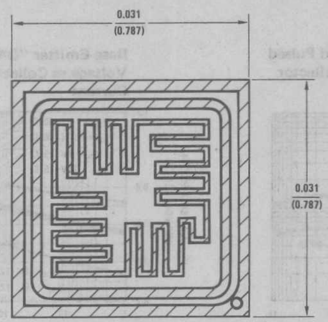
Safe Operating Area TO-202



Maximum Power Dissipation vs Case Temperature



Process 37 NPN Medium Power



DESCRIPTION

Process 37 is a double diffused silicon epitaxial planar device. Complement to Process 77.

APPLICATION

This device was designed for general purpose medium power amplifiers and switching circuits that require collector currents to 1A.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
BV_{CEO}	$I_C = 10$ mA	25		45	V
BV_{CBO}	$I_C = 100\mu A$	50			V
BV_{EBO}	$I_E = 100\mu A$	5	7		V
I_{CBO}	$V_{CB} = BV_{CEO}$		50	500	nA
I_{EBO}	$V_{EB} = 5V$		0.1	100	μA
h_{FE}	$I_C = 500$ mA, $V_{CE} = 1V$	100		400	
$V_{CE(SAT)}$	$I_C = 1A$, $I_B = 0.1A$		0.2	0.5	V
$V_{BE(SAT)}$	$I_C = 1A$, $I_B = 0.1A$		0.95	1.5	V
f_T	$I_C = 100$ mA, $V_{CE} = 10V$		300		MHz
C_{OBO}	$V_{CB} = 10V$			20	pF

AVAILABLE DEVICE TYPES

TO-202 (Package 35)

NSD102
NSD103
NSDU01
NSDU01A

TO-202 (Package 36)

D42C1
D42C2
D42C3
D42C4
D42C5
D42C6
NSE180

92 PLUS (Package 90)

92PE37A
BD373A

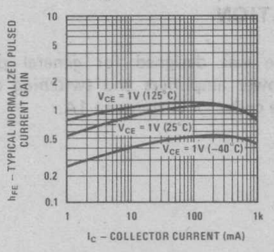
92 PLUS (Package 91)

92PU01
92PU01A

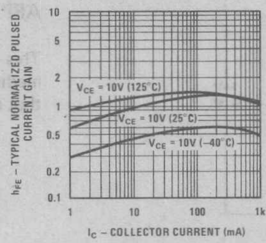
TO-126 (Package 38)

BD135

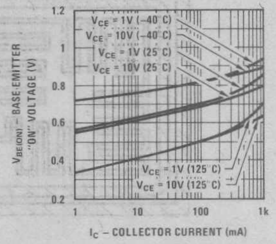
Typical Normalized Pulsed Current Gain vs Collector Current



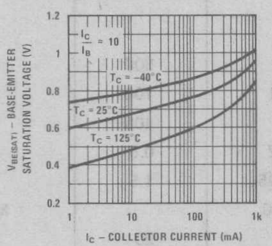
Typical Normalized Pulsed Current Gain vs Collector Current



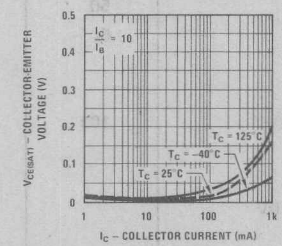
Base-Emitter "ON" Voltage vs Collector Current



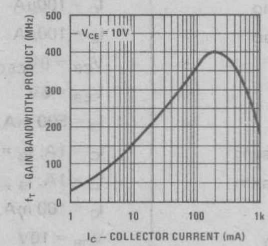
Base-Emitter Saturation Voltage vs Collector Current



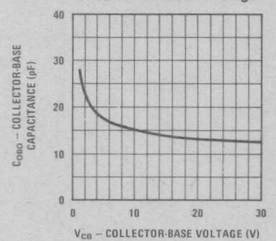
Collector-Emitter Voltage vs Collector Current



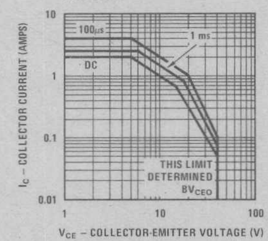
Gain Bandwidth Product vs Collector Current



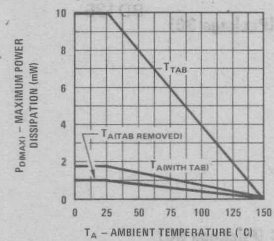
Collector-Base Capacitance vs Collector-Base Voltage

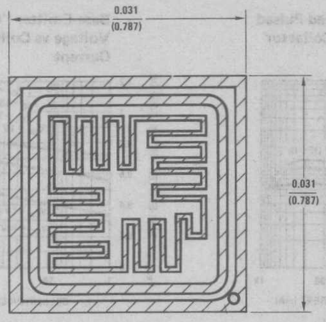


Safe Operating Area TO-202



Maximum Power Dissipation vs Ambient Temperature (TO-202)





DESCRIPTION

Process 38 is a double diffused silicon epitaxial planar device. Complement to Process 78.

APPLICATION

This device was designed for general purpose medium power amplifier and switching circuits that require collector currents to 1A.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
BV_{CEO}	$I_C = 10$ mA	45		80	V
BV_{CBO}	$I_C = 100\mu A$	90		160	V
BV_{EBO}	$I_E = 100\mu A$	5	7		V
I_{CBO}	$V_{CB} = BV_{CEO}$		50	500	nA
I_{EBO}	$V_{EB} = 5V$		0.1	100	μA
h_{FE}	$I_C = 100$ mA, $V_{CE} = 1V$	150		500	
$V_{CE(SAT)}$	$I_C = 500$ mA, $I_B = 50$ mA		0.2	0.5	V
$V_{BE(SAT)}$	$I_C = 500$ mA, $I_B = 50$ mA		0.8	1.4	V
f_T	$I_C = 100$ mA, $V_{CE} = 10V$		250		MHz
C_{OBO}	$V_{CB} = 10V$			15	pF

AVAILABLE DEVICE TYPES

TO-202 (Package 35)

NSDU05
NSD6178
NSD6179

TO-202 (Package 36)

D42C7
D42C8
D42C9
NSE181

92 PLUS (Package 90)

92PE37B
BD373B
BD373C

92 PLUS (Package 91)

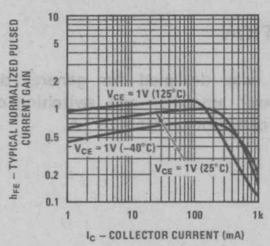
92PU05
BD371B
BD371C

TO-126 (Package 38)

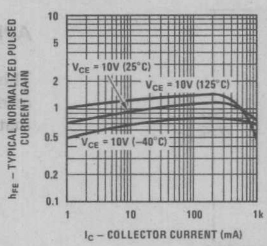
BD137

Process 38

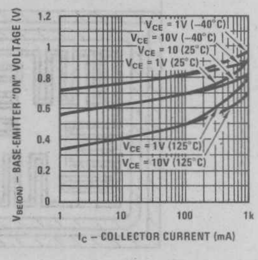
Typical Normalized Pulsed Current Gain vs Collector Current



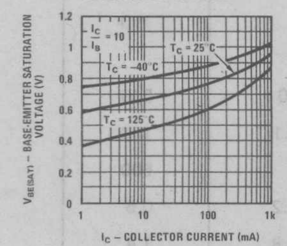
Typical Normalized Pulsed Current Gain vs Collector Current



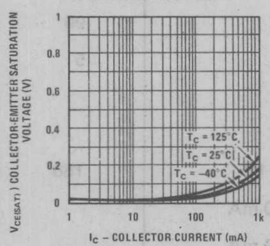
Base-Emitter "ON" Voltage vs Collector Current



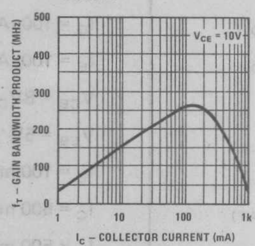
Base-Emitter Saturation Voltage vs Collector Current



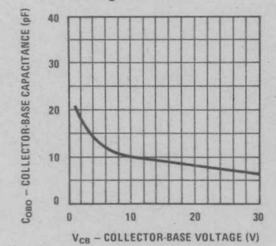
Collector-Emitter Saturation Voltage vs Collector Current



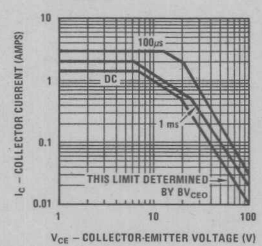
Gain Bandwidth Product vs Collector Current



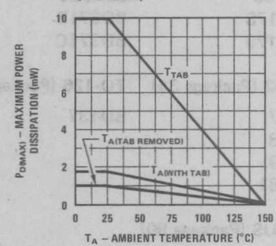
Collector-Base Capacitance vs Collector-Base Voltage



Safe Operating Area TO-202



Maximum Power Dissipation vs Ambient Temperature (TO-202)



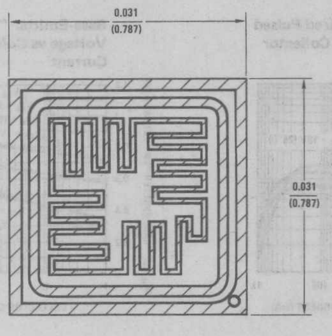
Process 39 NPN Medium Power

DESCRIPTION

Process 39 is a double diffused silicon epitaxial planar device. Complement to Process 79.

APPLICATION

This device was designed for general purpose medium power amplifier and switching circuits that require collector currents to 1A.



PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
BV_{CEO}	I_C = 10 mA	80		110	V
BV_{CBO}	I_C = 100μA	160		220	V
BV_{EBO}	I_E = 100μA	5	7		V
I_{CBO}	V_{CB} = BV_{CEO}		50	500	nA
I_{EBO}	V_{EB} = 5V		0.1	100	μA
h_{FE}	I_C = 100 mA, V_{CE} = 1V	100		350	
$V_{CE(SAT)}$	I_C = 500 mA, I_B = 50 mA		0.2	0.5	V
$V_{BE(SAT)}$	I_C = 500 mA, I_B = 50 mA		0.95	1.5	V
f_T	I_C = 100 mA, V_{CE} = 10V		120		MHz
C_{OBO}	V_{CB} = 10V			12	pF

AVAILABLE DEVICE TYPES

TO-202 (Package 35)

NSD104
NSD105
NSD106
NSDU06
NSDU07

92 PLUS (Package 90)

92PE37C
BD373D

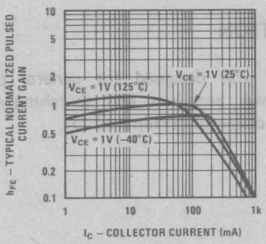
92 PLUS (Package 91)

92PU06
92PU07
BD371D

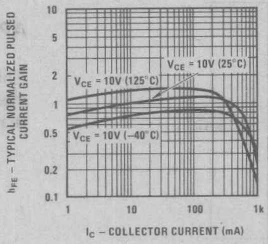
TO-126 (Package 38)

BD139

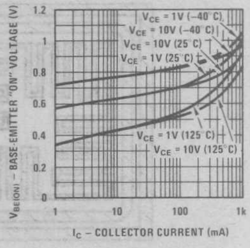
Typical Normalized Pulsed Current Gain vs Collector Current



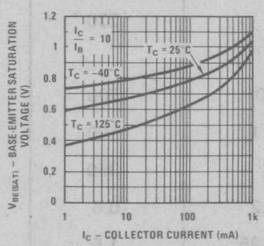
Typical Normalized Pulsed Current Gain vs Collector Current



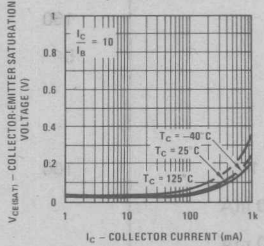
Base-Emitter "ON" Voltage vs Collector Current



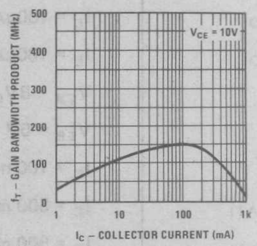
Base-Emitter Saturation Voltage vs Collector Current



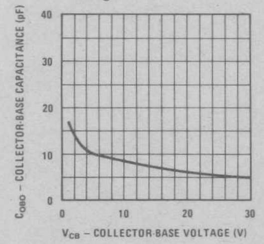
Collector-Emitter Saturation Voltage vs Collector Current



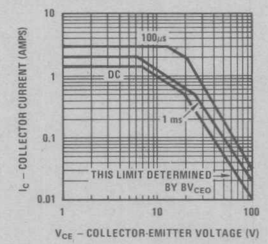
Gain Bandwidth Product vs Collector Current



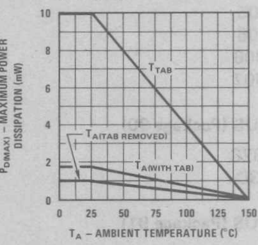
Collector-Base Capacitance vs Collector-Base Voltage



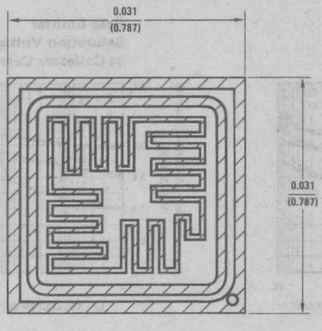
Safe Operating Area TO-202



Maximum Power Dissipation vs Ambient Temperature (TO-202)



Process 77 PNP Medium Power



DESCRIPTION

Process 77 is a double diffused silicon epitaxial planar device. Complement to Process 37.

APPLICATION

This device was designed for general purpose medium power amplifier and switching circuits that require collector currents to 1A.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
BV_{CEO}	I_C = 10 mA	25		45	V
BV_{CBO}	I_C = 100μA	40			V
BV_{EBO}	I_E = 100μA	5	7		V
I_{CBO}	V_{CB} = BV_{CEO}		50	500	nA
I_{EBO}	V_{EB} = 5V		0.1	100	μA
h_{FE}	I_C = 500 mA, V_{CE} = 1V	50		250	
$V_{CE(SAT)}$	I_C = 1A, I_B = 0.1A		0.3	0.5	V
$V_{BE(SAT)}$	I_C = 1A, I_B = 0.1A		1.0	1.5	V
f_T	I_C = 100 mA, V_{CE} = 10V		200		MHz
C_{OBO}	V_{CB} = 10V			20	pF

AVAILABLE DEVICE TYPES

TO-202 (Package 35)

NSD202
NSD203
NSDU51
NSDU51A

TO-202 (Package 36)

D43C1
D43C2
D43C3
D43C4
D43C5
D43C6
NSE170

92 PLUS (Package 90)

92PE77A
BD372A

92 PLUS (Package 91)

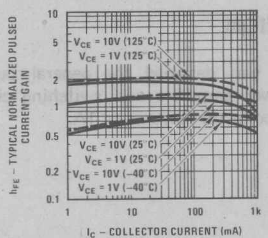
92PU51
92PU51A
BD370A

TO-126 (Package 38)

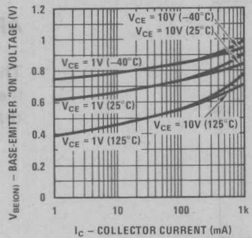
BD136

Process 77

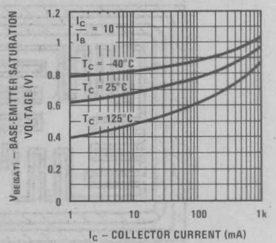
Typical Normalized Pulsed Current Gain vs Collector Current



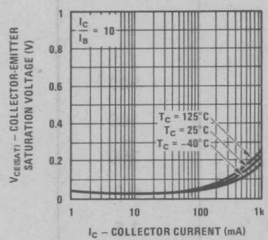
Base-Emitter "ON" Voltage vs Collector Current



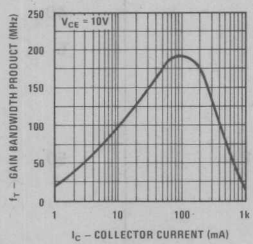
Base-Emitter Saturation Voltage vs Collector Current



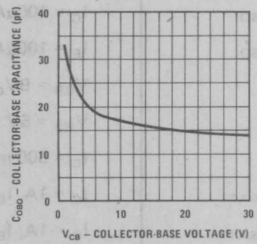
Collector-Emitter Saturation Voltage vs Collector Current



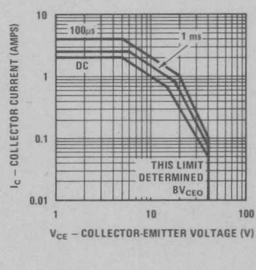
Gain Bandwidth Product vs Collector Current



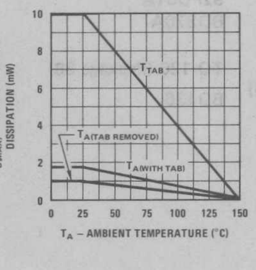
Collector-Base Capacitance vs Collector-Base Voltage



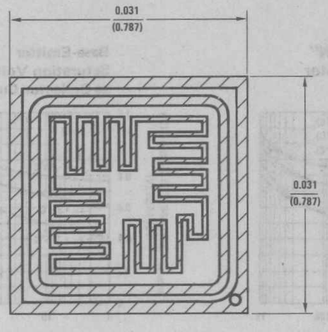
Safe Operating Area TO-202



Maximum Power Dissipation vs Ambient Temperature (TO-202)



Process 78 PNP Medium Power



DESCRIPTION

Process 78 is a double diffused silicon epitaxial planar device complement to Process 38.

APPLICATION

This device was designed for general purpose medium power amplifier and switching circuits that require collector currents to 1A.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
BV_{CEO}	$I_C = 10$ mA	45		80	V
BV_{CBO}	$I_C = 100\mu A$	75		110	V
BV_{EBO}	$I_E = 100\mu A$	5	7		V
I_{CBO}	$V_{CB} = BV_{CEO}$		50	500	nA
I_{EBO}	$V_{EB} = 5V$		0.1	100	μA
h_{FE}	$I_C = 100$ mA, $V_{CE} = 1V$	50		250	
$V_{CE(SAT)}$	$I_C = 500$ mA, $I_B = 50$ mA		0.2	0.5	V
$V_{BE(SAT)}$	$I_C = 500$ mA, $I_B = 50$ mA		0.95	1.4	V
f_T	$I_C = 100$ mA, $V_{CE} = 10V$	50			MHz
C_{OBO}	$V_{CB} = 10V$			15	pF

AVAILABLE DEVICE TYPES

TO-202 (Package 35)

NSDU55
NSD6180
NSD6181

TO-126 (Package 38)

BD138

TO-202 (Package 36)

D43C7
D43C8
D43C9
NSE171

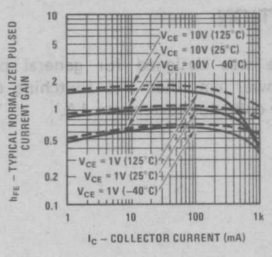
92 PLUS (Package 90)

92PE77B
BD372B
BD372C

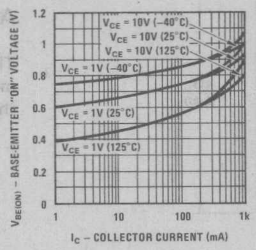
92 PLUS (Package 91)

92PU55
BD370B
BD370C

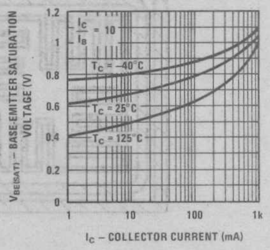
Typical Normalized Pulsed Current Gain vs Collector Current



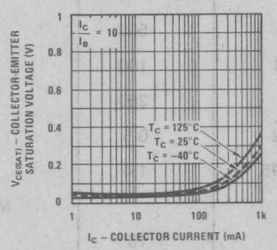
Base-Emitter "ON" Voltage vs Collector Current



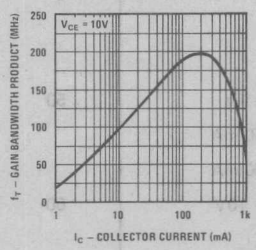
Base-Emitter Saturation Voltage vs Collector Current



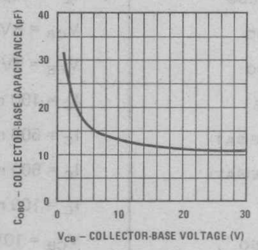
Collector-Emitter Saturation Voltage vs Collector Current



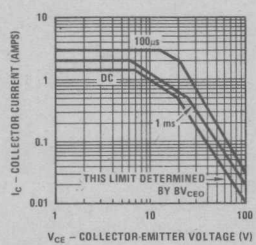
Gain Bandwidth Product vs Collector Current



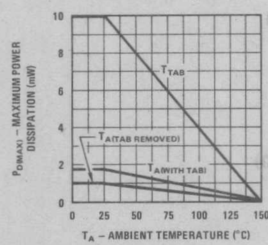
Collector-Base Capacitance vs Collector-Base Voltage

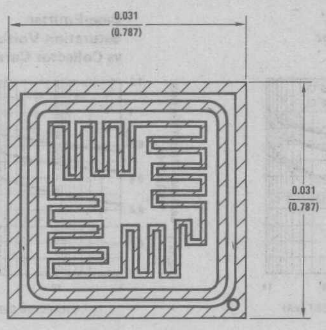


Safe Operating Area TO-202



Maximum Power Dissipation vs Ambient Temperature





DESCRIPTION

Process 79 is a double diffused silicon epitaxial planar device complement to Process 39.

APPLICATION

This device was designed for general purpose medium power amplifier and switching circuits that require collector currents to 1A.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
BV_{CEO}	$I_C = 10$ mA	80		110	V
BV_{CBO}	$I_C = 100\ \mu$A	110		140	V
BV_{EBO}	$I_E = 100\ \mu$A	5	7		V
I_{CBO}	$V_{CB} = BV_{CEO}$		50	500	nA
I_{EBO}	$V_{EB} = 5V$		0.1	100	μA
h_{FE}	$I_C = 100$ mA, $V_{CE} = 1V$	25		150	
$V_{CE(SAT)}$	$I_C = 500$ mA, $I_B = 50$ mA		0.2	0.5	V
$V_{BE(SAT)}$	$I_C = 500$ mA, $I_B = 50$ mA		0.9	1.4	V
f_T	$I_C = 100$ mA, $V_{CE} = 10V$	50	120		MHz
C_{OBO}	$V_{CB} = 10V$			15	pF

AVAILABLE DEVICE TYPES

TO-202 (Package 35)

NSD204
NSD205
NSD206
NSDU56
NSDU57

92 PLUS (Package 90)

92PE77C
BD372D

92 PLUS (Package 91)

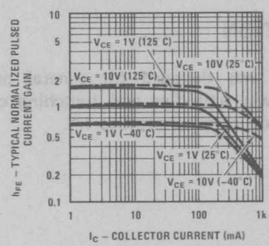
92PU56
92PU57
BD370D

TO-126 (Package 38)

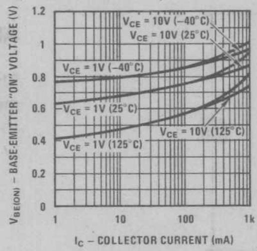
BD140

Process 79

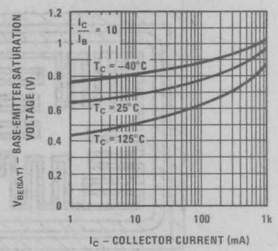
Typical Normalized Pulsed Current Gain vs Collector Current



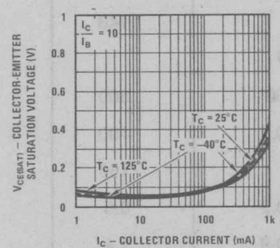
Base-Emitter "ON" Voltage vs Collector Current



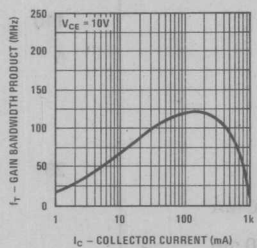
Base-Emitter Saturation Voltage vs Collector Current



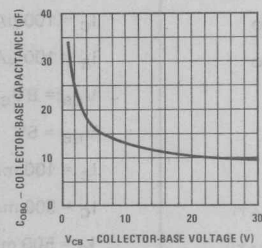
Collector-Emitter Saturation Voltage vs Collector Current



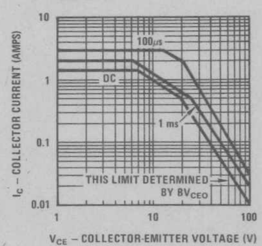
Gain Bandwidth Product vs Collector Current



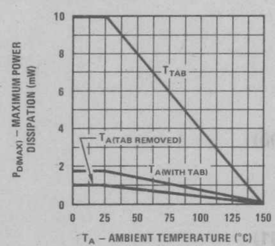
Collector-Base Capacitance vs Collector-Base Voltage



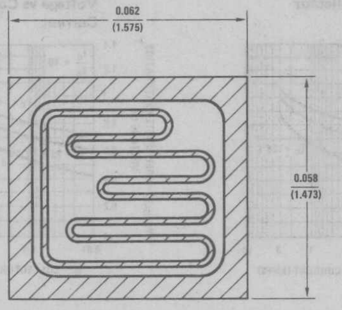
Safe Operating Area TO-202



Maximum Power Dissipation vs Ambient Temperature (TO-202)



Process 2C NPN Epitaxial Power



DESCRIPTION

Process 2C is a double epitaxial silicon mesa with diffused emitter.

APPLICATION

This device was designed for general purpose power amplifier and switching circuits where a large safe operating area is required.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
BV_{CEO}	I_C = 100 mA, (Note 1)	30		100	V
BV_{CBO}	I_C = 1 mA	60		200	V
BV_{EBO}	I_E = 1mA	5	8		V
I_{CEO}	$V_{CE} = BV_{CEO} - 10V$		10	300	μA
I_{CBO}	$V_{CB} = BV_{CEO}$		0.1	10	μA
I_{EBO}	V_{EB} = 5V		10	100	μA
h_{FE}	I_C = 1.0A, V_{CE} = 1V, (Note 1)	15		200	
$V_{CE(SAT)}$	I_C = 2.0A, I_B = 0.3A, (Note 1)			0.5	V
$V_{BE(ON)}$	I_C = 2.0A, V_{CE} = 2.0V, (Note 1)			1.0	V
SOA	V_{CE} = 33.3V, t = 1 sec	0.9			A
f_T	I_C = 0.5A, V_{CE} = 2V	4			MHz
t_d	I_C = 1A, $I_{B1} = I_{B2}$ = 0.1A, V_{CC} = 40V		0.05		μs
t_r	I_C = 1A, $I_{B1} = I_{B2}$ = 0.1A, V_{CC} = 40V		0.25		μs
t_s	I_C = 1A, $I_{B1} = I_{B2}$ = 0.1A, V_{CC} = 40V		0.75		μs
t_f	I_C = 1A, $I_{B1} = I_{B2}$ = 0.1A, V_{CC} = 40V		0.25		μs
$P_{D(MAX)}$	TO-220			40	W
	TO-126			30	W
	TO-202			12.5	W
θ_{jc}	TO-220			3.125	°C/W
	TO-126			4.167	°C/W
	TO-202			10.0	°C/W

Note 1: Pulsed measurement = 300μs pulse width.

AVAILABLE DEVICE TYPES

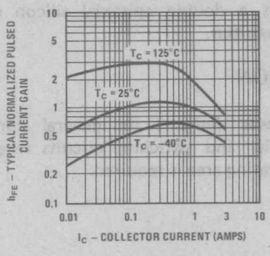
TO-220 (Package 37)

DC44C1	NSP520	TIP29B	TIP61A
DC44C2	NSP521	TIP29C	TIP61B
DC44C4	NSP4921	TIP31	TIP61C
DC44C5	NSP4922	TIP31A	
DC44C7	NSP4923	TIP31B	
DC44C8	TIP29	TIP31C	
DC44C10	TIP29A	TIP61	

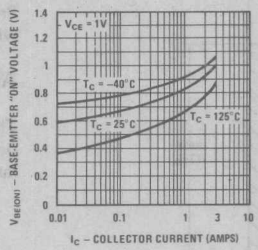
TO-126 (Package 38)

2N4921
2N4922
2N4923
MJE520
MJE521

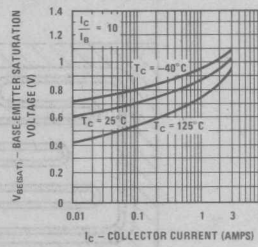
Current



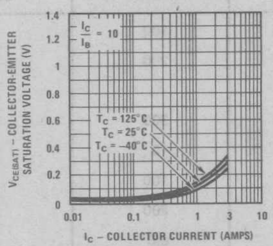
Current



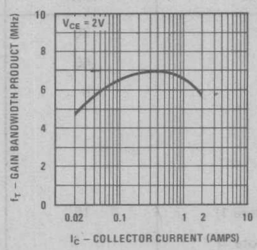
Current



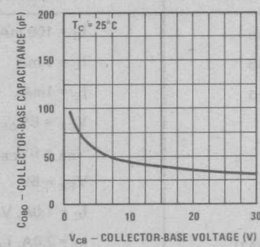
Collector-Emitter Saturation Voltage vs Collector Current



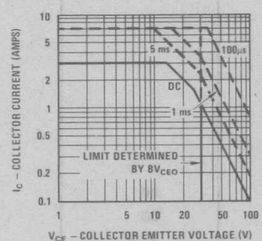
Gain Bandwidth Product vs Collector Current



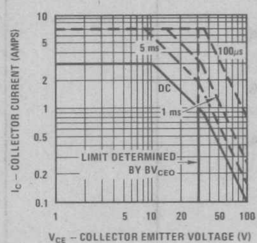
Collector-Base Capacitance vs Collector-Base Voltage



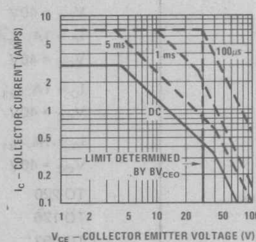
Safe Operating Area TO-220



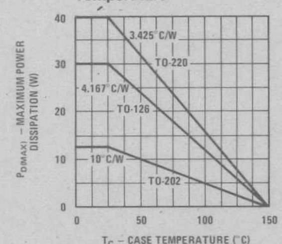
Safe Operating Area TO-126



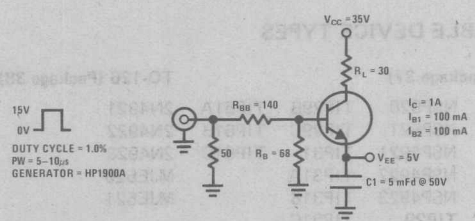
Safe Operating Area TO-202

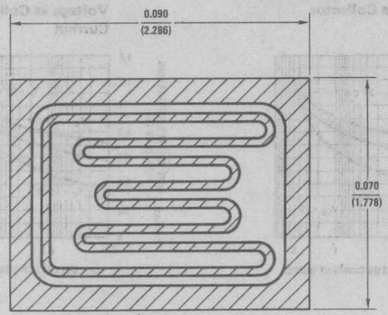


Maximum Power Dissipation vs Case Temperature



Switching Circuit





DESCRIPTION

Process 2E is a double epitaxial silicon mesa with diffused emitter.

APPLICATION

This device was designed for general purpose power amplifier and switching circuits where a large safe operation area is required.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
BV_{CEO}	I_C = 100 mA, (Note 1)	30	60	100	V
BV_{CBO}	I_C = 1 mA	50		200	V
BV_{EBO}	I_E = 1mA	5	8		V
I_{CEO}	$V_{CE} = BV_{CEO}$		50	300	μA
I_{CBO}	$V_{CB} = BV_{CEO}$		10	100	μA
I_{EBO}	V_{EB} = 5V		50	1000	μA
h_{FE}	I_C = 1.5A, V_{CE} = 2.0V, (Note 1)	20		200	
$V_{CE(SAT)}$	I_C = 4.0A, I_B = 0.6A, (Note 1)			0.6	V
$V_{BE(ON)}$	I_C = 4.0A, V_{CE} = 2.0V, (Note 1)			1.3	V
SOA	V_{CE} = 33.3V, t = 1 sec	1.2			A
f_T	I_C = 0.5A, V_{CE} = 2V, f = 1 MHz	4			MHz
t_d	I_C = 1.0A, I_{B1} = 0.1A, I_{B2} = 0.1A, V_{CC} = 30V		0.10		μs
t_r	I_C = 1.0A, I_{B1} = 0.1A, I_{B2} = 0.1A, V_{CC} = 30V		0.25		μs
t_s	I_C = 1.0A, I_{B1} = 0.1A, I_{B2} = 0.1A, V_{CC} = 30V		0.35		μs
t_f	I_C = 1.0A, I_{B1} = 0.1A, I_{B2} = 0.1A, V_{CC} = 30V		0.23		μs
$P_{D(MAX)}$	TO-220			50	W
	TO-126			40	W
	TO-202			15	W
θ_{jc}	TO-220			3.5	°C/W
	TO-126			3.125	°C/W
	TO-202			8.33	°C/W

Note 1: Pulsed measurement = 300μs pulse width

AVAILABLE DEVICE TYPES

TO-220 (Package 37)

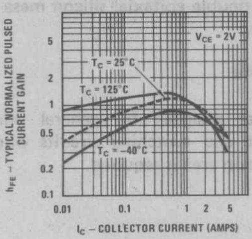
2N5293	2N6122	2N6290	D44C11	NSP5192
2N5294	2N6123	2N6291	D44C12	NSP5193
2N5295	2N6129	2N6292	NSP41	
2N5296	2N6130	2N6293	NSP41A	
2N5297	2N6131	D44C3	NSP41B	
2N5298	2N6288	D44C6	NSP41C	
2N6121	2N6289	D44C9	NSP5190	

TO-126 (Package 38)

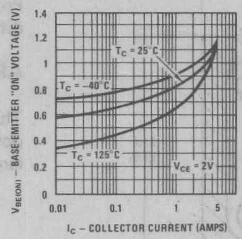
2N5190
2N5191
2N5192

Process 2E

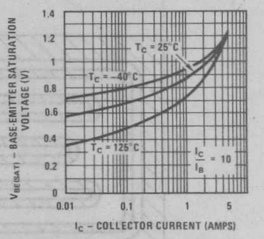
Typical Normalized Pulsed Current Gain vs Collector Current



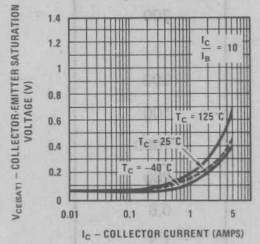
Base-Emitter "ON" Voltage vs Collector Current



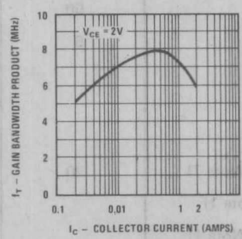
Base-Emitter Saturation Voltage vs Collector Current



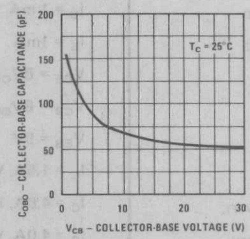
Collector-Emitter Saturation Voltage vs Collector Current



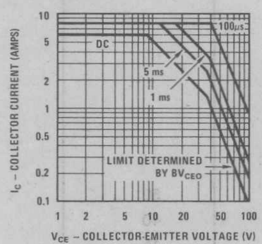
Gain Bandwidth Product vs Collector Current



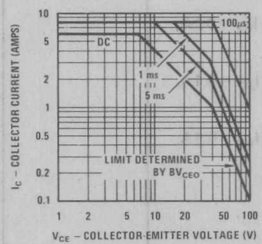
Typical Collector Capacitance vs Collector-Base Voltage



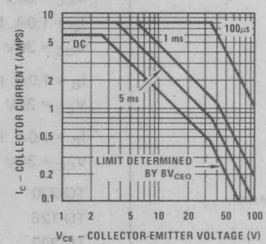
Safe Operating Area TO-220



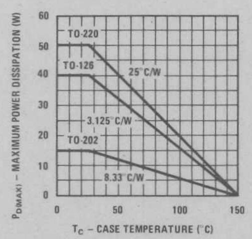
Safe Operating Area TO-126



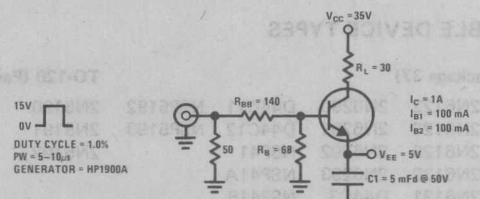
Safe Operating Area TO-202



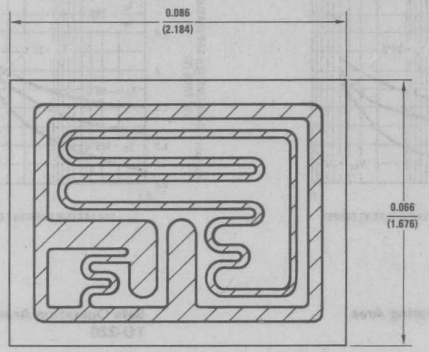
Maximum Power Dissipation vs Case Temperature



Switching Circuit



Process 2J NPN Power Darlington



DESCRIPTION

Process 2J is a double epitaxial silicon mesa device. Complement to Process 3J.

APPLICATION

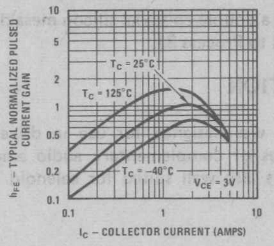
This device was designed for use in driver and output stages of complementary audio amplifier circuits. It is also well suited for solenoid driver applications.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
BV_{CEO}	I_C = 100 mA	30		100	V
BV_{CBO}	I_C = 100μA	50		120	V
BV_{EBO}	I_E = 2 mA	5			V
I_{CEO}	V_{CE} = 1/2 BV_{CEO}			0.5	mA
I_{CBO}	V_{CB} = BV_{CEO}			200	μA
I_{EBO}	V_{EB} = 5V			2.0	mA
h_{FE}	I_C = 2A, V_{CE} = 3V	500		15,000	
$V_{CE(SAT)}$	I_C = 5A, I_B = 2.0 mA			3.0	V
$V_{BE(ON)}$	I_C = 5A, V_{CE} = 3V			2.5	V
C_{OBO}	V_{CB} = 10V		30		pF
$\|h_{FE}\|$	I_C = 1A, V_{CE} = 3V, f = 1 MHz		9		
t_{ON}	I_C = 6A, V_{CE} = 30V, *(Figure 1)*		1.25		μs
t_{OFF}	I_C = 6A, V_{CE} = 30V, *(Figure 1)*		2.75		μs

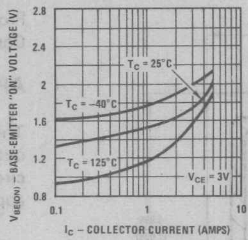
AVAILABLE DEVICE TYPES

TO-126 (Package 38)	TO-220 (Package 37)
2N6037	2N6386
2N6038	TIP110
2N6039	TIP111
MJE800	TIP112
MJE801	NSP2100
MJE802	NSP2101
MJE803	NSP2102
	NSP2103

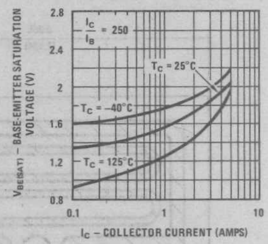
Current



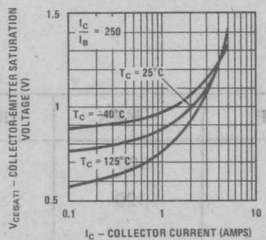
Current



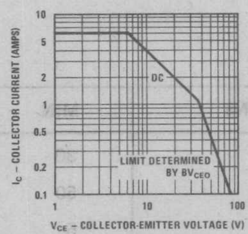
Voltage vs Collector Current



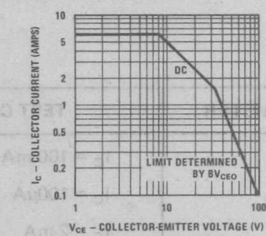
Collector-Emitter Saturation Voltage vs Collector Current



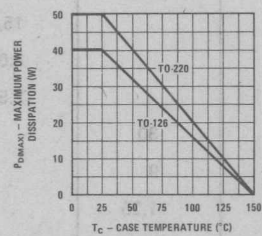
Safe Operating Area TO-126



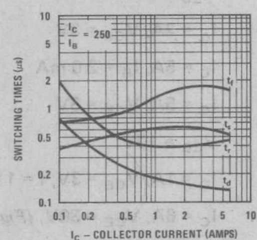
Safe Operating Area TO-220



Maximum Power Dissipation vs Case Temperature



Switching Times vs Collector Current



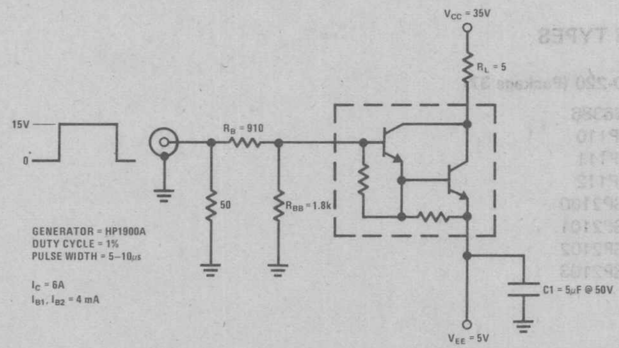
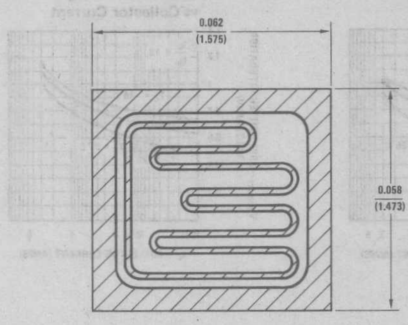


FIGURE 1



DESCRIPTION

Process 3C is a double epitaxial silicon mesa with diffused emitter.

APPLICATION

This device was designed for general purpose power amplifier and switching circuits where a large safe operating area is required.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
BV_{CEO}	I_C = 100 mA, (Note 1)	30		100	V
BV_{CBO}	I_C = 1 mA	50		200	V
BV_{EBO}	I_E = 1mA	5	6.5		V
I_{CEO}	$V_{CE} = BV_{CEO} - 10V$		10	300	μA
I_{CBO}	$V_{CB} = BV_{CEO}$		0.1	10	μA
I_{EBO}	V_{EB} = 5V		10	100	μA
h_{FE}	I_C = 1.0A, V_{CE} = 1V, (Note 1)	15		200	
$V_{CE(SAT)}$	I_C = 2.0A, I_B = 0.3A, (Note 1)			0.5	V
$V_{BE(ON)}$	I_C = 2.0A, V_{CE} = 2.0V, (Note 1)			1.0	V
SOA	V_{CE} = 33.3V, t = 1 sec	0.9			A
f_T	I_C = 0.5A, V_{CE} = 2V	4			MHz
t_d	I_C = 1A, $I_{B1} = I_{B2}$ = 0.1A, V_{CC} = 40V		0.03		μs
t_r	I_C = 1A, $I_{B1} = I_{B2}$ = 0.1A, V_{CC} = 40V		0.20		μs
t_s	I_C = 1A, $I_{B1} = I_{B2}$ = 0.1A, V_{CC} = 40V		0.26		μs
t_f	I_C = 1A, $I_{B1} = I_{B2}$ = 0.1A, V_{CC} = 40V		0.20		μs
$P_{D(MAX)}$	TO-220			40	W
	TO-126			30	W
	TO-202			12.5	W
θ_{jc}	TO-220			3.125	°C/W
	TO-126			4.167	°C/W
	TO-202			10.0	°C/W

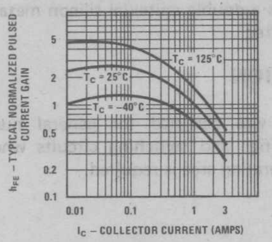
Note 1: Pulsed measurement = 300μs pulse width.

AVAILABLE DEVICE TYPES

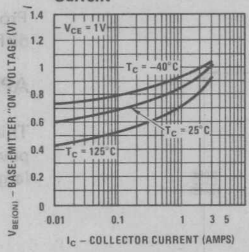
TO-220 (Package 37)						**TO-126 (Package 38)**
D45C1	D45C7	NSP370	TIP30	TIP32	TIP62	2N4918
D45C2	D45C8	NSP4918	TIP30A	TIP32A	TIP62A	2N4919
D45C4	D45C10	NSP4919	TIP30B	TIP32B	TIP62B	2N4920
D45C5	D45C11	NSP4920	TIP30C	TIP32C	TIP62C	MJE370

Process 3C

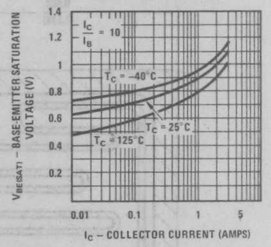
Typical Normalized Pulsed Current Gain vs Collector Current



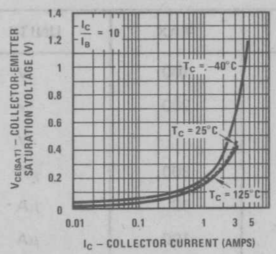
Base-Emitter "ON" Voltage vs Collector Current



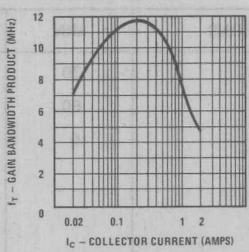
Base-Emitter Saturation Voltage vs Collector Current



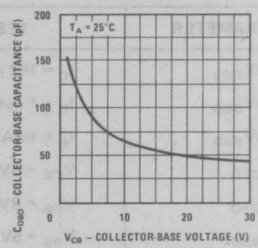
Collector-Emitter Saturation Voltage vs Collector Current



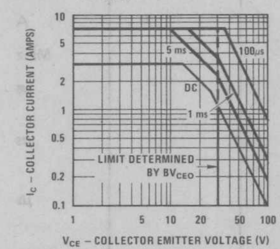
Gain Bandwidth Product vs Collector Current



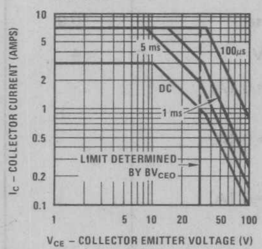
Typical Collector Capacitance vs Collector-Base Voltage



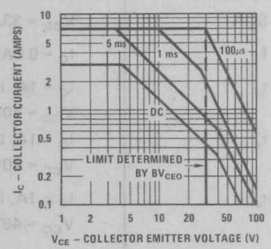
Safe Operating Area TO-220



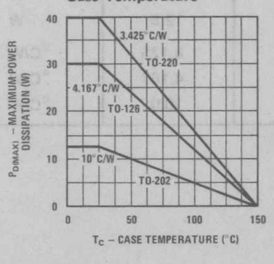
Safe Operating Area TO-126



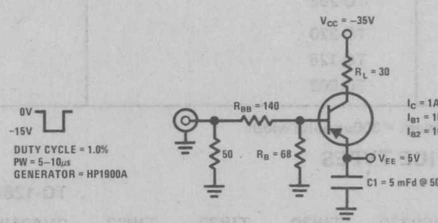
Safe Operating Area TO-202



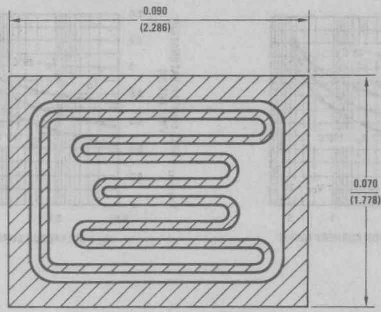
Maximum Power Dissipation vs Case Temperature



Switching Circuit



Process 3E PNP Epitaxial Power



DESCRIPTION

Process 3E is a double epitaxial silicon mesa with diffused emitter.

APPLICATION

This device was designed for general purpose power amplifier and switching circuits where a large safe operation area is required.

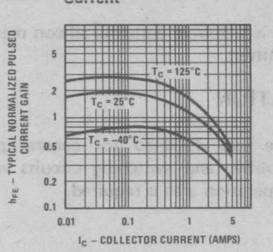
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
BV_{CEO}	I_C = 100 mA, (Note 1)	30	60	100	V
BV_{CBO}	I_C = 1 mA	40		150	V
BV_{EBO}	I_E = 1mA	5	8		V
I_{CEO}	$V_{CE} = BV_{CEO}$		50	300	μA
I_{CBO}	$V_{CB} = BV_{CEO}$		10	100	μA
I_{EBO}	V_{EB} = 5V		50	1000	μA
h_{FE}	I_C = 1.5A, V_{CE} = 2.0V, (Note 1)	20		170	
$V_{CE(SAT)}$	I_C = 4.0A, I_B = 0.6A, (Note 1)			0.65	V
$V_{BE(ON)}$	I_C = 4.0A, V_{CE} = 2.0V, (Note 1)			1.3	V
SOA	V_{CE} = 33.3V, t = 1 sec	1.2			A
f_T	I_C = 0.5A, V_{CE} = 2V, f = 1 MHz	4			MHz
t_d	I_C = 1.0A, I_{B1} = 0.1A, I_{B2} = 0.1A, V_{CE} = 30V		0.10		μs
t_r	I_C = 1.0A, I_{B1} = 0.1A, I_{B2} = 0.1A, V_{CE} = 30V		0.25		μs
t_s	I_C = 1.0A, I_{B1} = 0.1A, I_{B2} = 0.1A, V_{CE} = 30V		0.40		μs
t_f	I_C = 1.0A, I_{B1} = 0.1A, I_{B2} = 0.1A, V_{CE} = 30V		0.23		μs
$P_{D(MAX)}$	TO-220			50	W
	TO-126			40	W
	TO-202			15	W
θ_{jc}	TO-220			2.5	°C/W
	TO-126			3.125	°C/W
	TO-202			8.33	°C/W

Note 1: Pulsed measurement = 300μs pulse width.

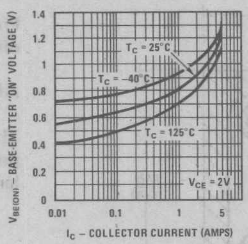
AVAILABLE DEVICE TYPES

TO-220 (Package 37)				TO-126 (Package 38)
2N6106	2N6124	D45C3	NSP42B	2N5193
2N6107	2N6125	D45C6	NSP42C	2N5194
2N6108	2N6126	D45C9	NSP371	2N5195
2N6109	2N6132	D45C12	NSP5193	MJE371
2N6110	2N6133	NSP42	NSP5194	
2N6111	2N6134	NSP42A	NSP5195	

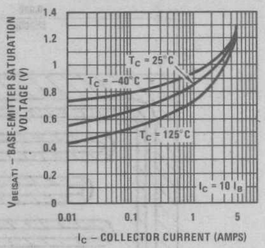
Current



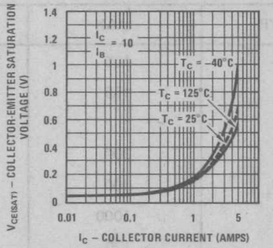
Current



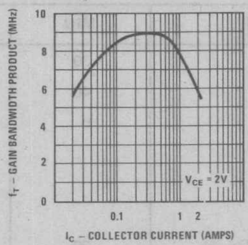
vs Collector Current



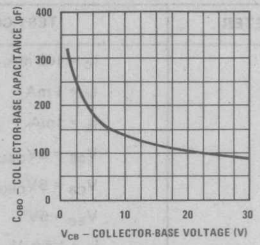
Collector-Emitter Saturation Voltage vs Collector Current



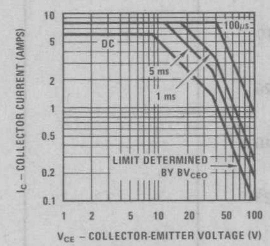
Gain Bandwidth Product vs Collector Current



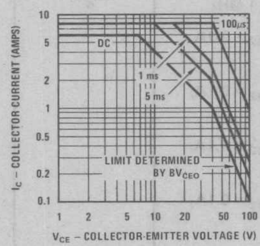
Collector-Base Capacitance vs Collector-Base Voltage



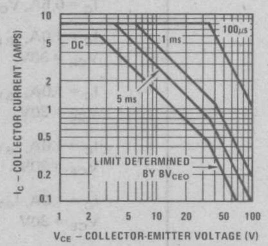
Safe Operating Area TO-220



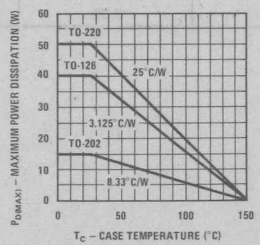
Safe Operating Area TO-126



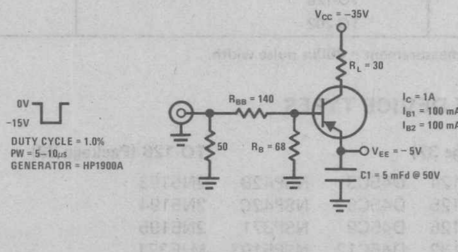
Safe Operating Area TO-202



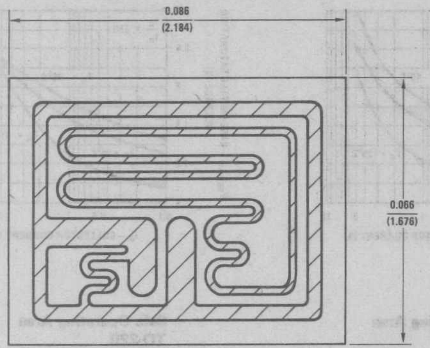
Maximum Power Dissipation vs Case Temperature



Switching Circuit



Process 3J PNP Power Darlington



DESCRIPTION

Process 3J is a double epitaxial silicon mesa device. Complement to Process 2J.

APPLICATION

This device was designed for use in driver and output stages of complementary audio amplifier circuits. It is also well suited for solenoid driver applications.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
BV_{CEO}	$I_C = 100$ mA	30		100	V
BV_{CBO}	$I_C = 100 \mu A$	50		120	V
BV_{EBO}	$I_E = 2$ mA	5			V
I_{CEO}	$V_{CE} = 1/2\ BV_{CEO}$			0.5	mA
I_{CBO}	$V_{CB} = BV_{CEO}$			200	μA
I_{EBO}	$V_{EB} = 5V$			2.0	mA
h_{FE}	$I_C = 2A$, $V_{CE} = 3V$	500			
$V_{CE(SAT)}$	$I_C = 5A$, $I_B = 2.0$ mA			3.3	V
$V_{BE(ON)}$	$I_C = 5A$, $V_{CE} = 3V$			2.8	V
C_{OBO}	$V_{CB} = 10V$		35		pF
$\|h_{FE}\|$	$I_C = 1A$, $V_{CE} = 3V$, f = 1 MHz		4		
t_{ON}	$I_C = 6A$, $V_{CE} = 30V$, *(Figure 1)*		2.0		
t_{OFF}	$I_C = 6A$, $V_{CE} = 30V$, *(Figure 1)*		2.6		

AVAILABLE DEVICE TYPES

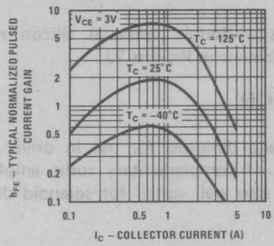
TO-126 (Package 38)

2N6034
2N6035
2N6036
MJE700
MJE701
MJE702
MJE703

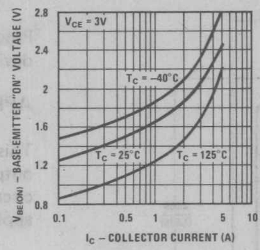
TO-220 (Package 37)

TIP115
TIP116
TIP117
NSP2090
NSP2091
NSP2092
NSP2093

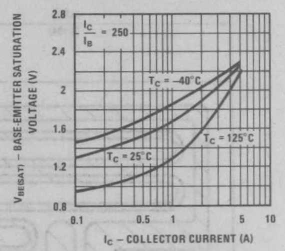
Typical Normalized Pulsed Current Gain vs Collector Current



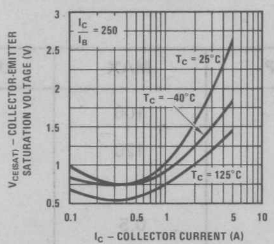
Base-Emitter "ON" Voltage vs Collector Current



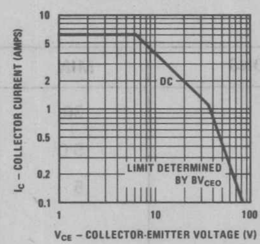
Base-Emitter Saturation Voltage vs Collector Current



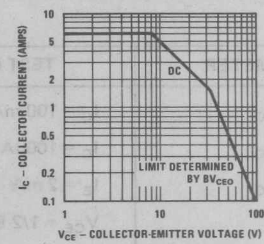
Collector-Emitter Saturation Voltage vs Collector Current



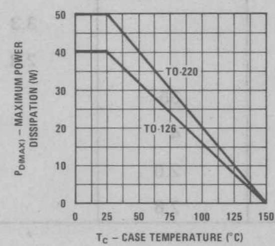
Safe Operating Area TO-126



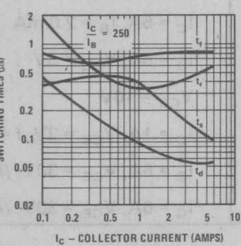
Safe Operating Area TO-220



Maximum Power Dissipation vs Case Temperature



Switching Times vs Collector Current



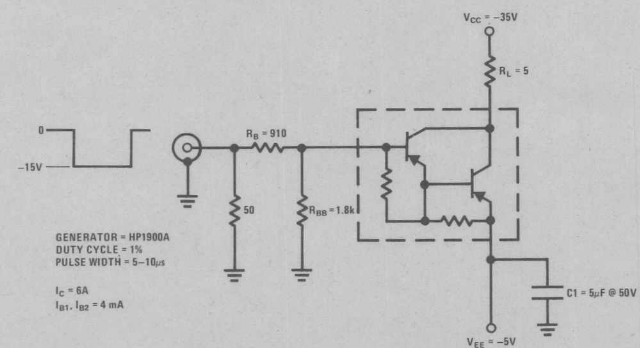
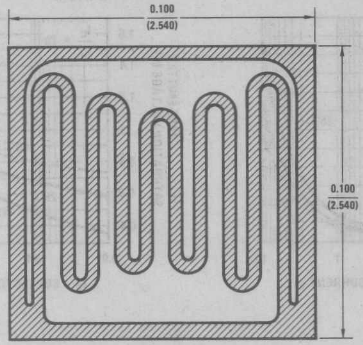


Figure 1.

Process 4A Epitaxial Power



DESCRIPTION

Process 4A is a double epitaxial silicon NPN mesa device with diffused emitter.

APPLICATION

This device was designed for general purpose power amplifier and switching circuits where a large safe operating area is required.

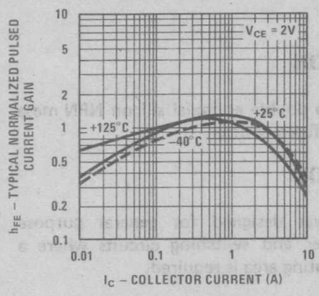
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
BV_{CEO}	$I_C = 200$ mA, (Note 1)	40		100	V
BV_{CBO}	$I_C = 1$ mA	60			V
BV_{EBO}	$I_E = 0.5$ mA	5	7		V
I_{CEO}	$V_{CE} = BV_{CEO} - 10V$		10	200	μA
I_{CBO}	$V_{CB} = BV_{CEO} + 20V$		1	20	μA
I_{EBO}	$V_{EB} = 5V$		1	500	μA
h_{FE}	$I_C = 2.5$ A, $V_{CE} = 2V$	20		160	
$V_{CE(SAT)}$	$I_C = 4$ A, $I_B = 0.4$ A		0.4	0.6	V
$V_{BE(ON)}$	$I_C = 5$ A, $V_{CE} = 2V$		1.1	1.3	V
S_{OA}	$I_C = 3$ A, t = 1 sec	30			V
f_t	$I_C = 0.5$ A, $V_{CE} = 5V$, f = 1 MHz	2			
t_d	$I_C = 5$ A, $I_{B1} = I_{B2} = 0.5$ A $V_{CC} = 40V$		0.07		μs
t_r	$I_C = 5$ A, $I_{B1} = I_{B2} = 0.5$ A, $V_{CC} = 40V$		0.8		μs
t_s	$I_C = 5$ A, $I_{B1} = I_{B2} = 0.5$ A, $V_{CC} = 40V$		0.4		μs
t_f	$I_C = 5$ A, $I_{B1} = I_{B2} = 0.5$ A, $V_{CC} = 40V$		0.5		μs
$P_{D(MAX)}$	TO-220	60			
θ_{jc}	TO-220			2.08	°C/W

Note 1: Pulsed measurement = 300 μs pulse width.

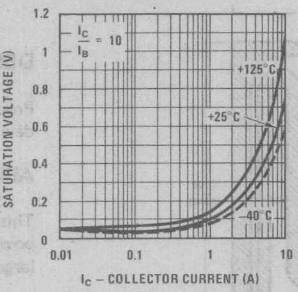
AVAILABLE DEVICE TYPES

NSP5977	NSP3055	D44H1	D44H10
NSP5978	2N6098, 2N6099	D44H2	D44H11
NSP5979	2N6102, 2N6103	D44H4	NSP2480
NSP2020	2N6100, 2N6101	D44H5	NSP2481
NSP2021	2N6486	D44H7	NSP2482
NSP205	2N6487	D44H8	NSP2483

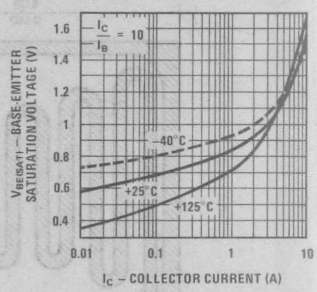
Typical Normalized Pulsed Current Gain vs Collector Current



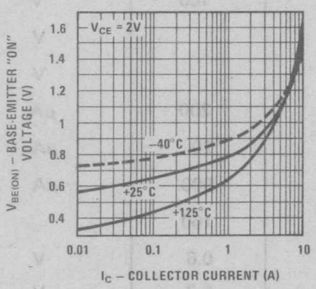
Collector-Emitter Saturation Voltage vs Collector Current



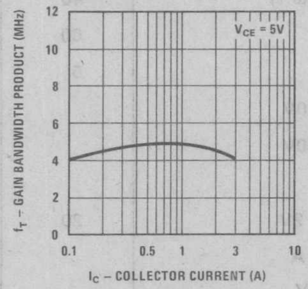
Base-Emitter Saturation Voltage vs Collector Current



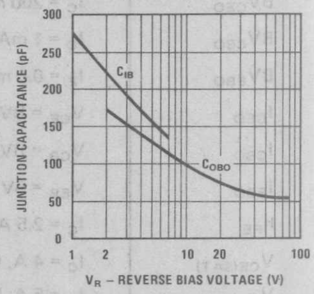
Base-Emitter "ON" Voltage vs Collector Current



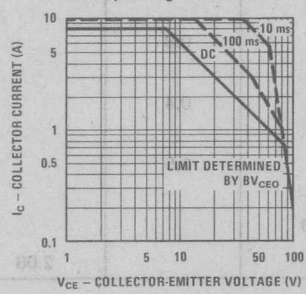
Gain Bandwidth Product vs Collector Current



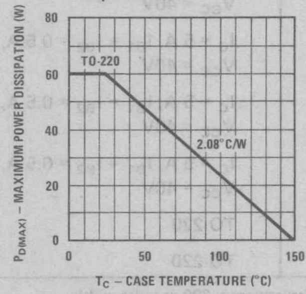
Junction Capacitance vs Reverse Bias Voltage



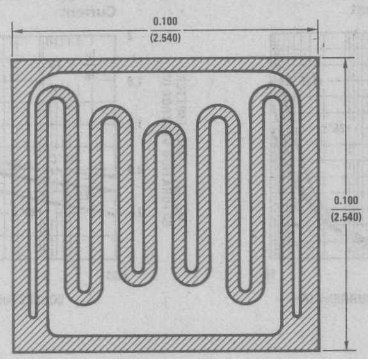
Safe Operating Area TO-220



Maximum Power Dissipation vs Case Temperature



Process 5A Epitaxial Power



DESCRIPTION

Process 5A is a double epitaxial silicon PNP mesa device with a diffused emitter.

APPLICATION

This device was designed for general purpose power amplifier and switching circuits where a large safe operating area is required.

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
BV_{CEO}	I_C = 200 mA, (Note 1)	40		100	V
BV_{CBO}	I_C = 1 mA	60		150	V
BV_{EBO}	I_E = 0.5 mA	5	7		V
I_{CEO}	$V_{CE} = BV_{CEO} - 10V$		10	200	μA
I_{CBO}	$V_{CB} = BV_{CEO} + 20V$		1	20	μA
I_{EBO}	V_{EB} = 5V		1	500	μA
h_{FE}	I_C = 2.5 A, V_{CE} = 2V	20		200	
$V_{CE(SAT)}$	I_C = 4 A, I_B = 0.4 A		0.5	0.6	V
$V_{BE(ON)}$	I_C = 5 A, V_{CE} = 2V		1.2	1.3	V
S_{OA}	I_C = 3 A, t = 1 sec	30			V
f_t	I_C = 0.5 A, V_{CE} = 5V, f = 1 MHz	2			
t_d	I_C = 5 A, $I_{B1} = I_{B2}$ = 0.5 A V_{CC} = 40V		0.03		μs
t_r	I_C = 5 A, $I_{B1} = I_{B2}$ = 0.5 A, V_{CC} = 40V		0.27		μs
t_s	I_C = 5 A, $I_{B1} = I_{B2}$ = 0.5 A, V_{CC} = 40V		0.3		μs
t_f	I_C = 5 A, $I_{B1} = I_{B2}$ = 0.5 A, V_{CC} = 40V		0.37		μs
$P_{D(MAX)}$	TO-220	60			
θ_{jc}	TO-220			2.08	°C/W

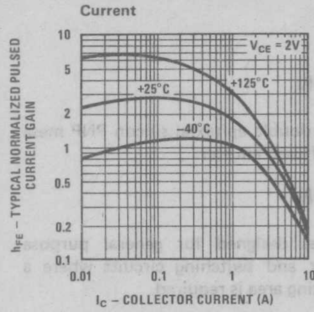
Note 1: Pulsed measurement = 300 μs pulse width.

AVAILABLE DEVICE TYPES

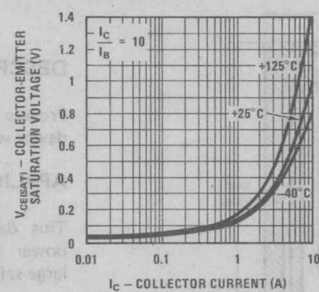
NSP5974	NSP2955	D45H4
NSP5975	2N6489	D45H5
NSP5976	2N6490	D45H7
NSP2010	2N6491	D45H8
NSP2011	D45H1	D45H10
NSP105	D45H2	D45H11

Process 5A

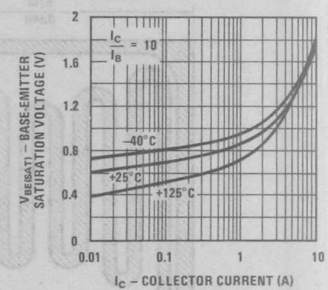
Typical Normalized Pulsed Current Gain vs Collector Current



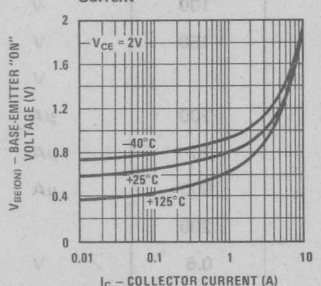
Collector-Emitter Saturation Voltage vs Collector Current



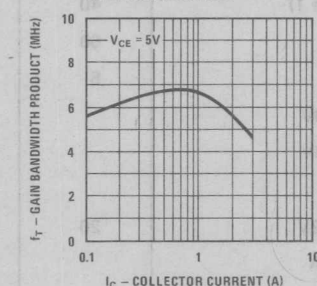
Base-Emitter Saturation Voltage vs Collector Current



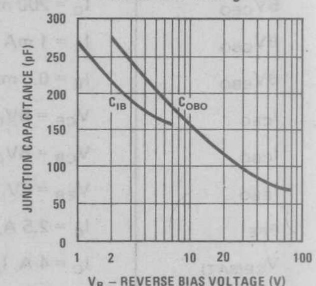
Base-Emitter "ON" Voltage vs Collector Current



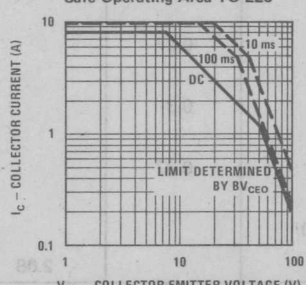
Gain Bandwidth Product vs Collector Current



Junction Capacitance vs Reverse Bias Voltage



Safe Operating Area TO-220



Maximum Power Dissipation vs Case Temperature